HIGHLIGHTS

REVISION NO. 33 Jun 01/10

Pages which have been revised are outlined below, together with the Highlights of the Revision

CH/SE/SU C PAGES	REASON FOR CHANGE	EFFECTIVITY
CHAPTER 70		
L.E.P. 1- 3	Revised to Reflect this revision indicating new,revised, and/or deleted pages	
T. OF C. 1- 4	Revised to reflect this revision	
70-00-00 201- 235, 237-B231	Minor, non technical corrections CORRECTED TYPO ERRORS. Minor additions and amplification . ADDED DEFINITIONS. . CLARIFIED SAFETY WIRE MATERIALS QUALITIES AND UPDATED GENERAL SPECIFICATION TO AGREE WITH PWA 316 REQUIREMENTS. . REVISED APPLICATION OF ANTIGALLING AND ANTISEIZE COMPOUNDS. . REVISED SPOP 1 PROCEDURE. . REVISED CONSUMABLE MATERIALS LIST. . REVISED SUPPLIER SOURCE CODE LIST. Layout improved	
70-22-16 257	Minor additions and amplification ADDED TYPICAL RIVET REMOVAL TOOLS AND SOURCES	

CHAPTER 70

STD. PRACTICES-ENGINE

LIST OF EFFECTIVE PAGES

N, R or D indicates pages which are New, Revised or Deleted respectively
Remove and insert the affected pages and complete the Record of Revisions and the Record of Temporary Revisions as necessary

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OF TEMP.			
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CHAPTER 70

STD. PRACTICES-ENGINE

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R 1. Standard Practices - Power Plant - General

R A. Procedure
R (1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
R (2)For information on the materials specified in this Standard Practices section, refer to the list of consumable materials (Ref. 70-00-00, P. Block 201) which lists all materials used in all Power Plant related sections of this manual.

R B. Definitions
R (1)**WARNING :**
R **A WARNING** tells the operator that injury or death is possible if the operator does not obey the specified instruction.
R (a)**WARNING** statements that are applicable to an instruction will precede (come before) the instruction and all **CAUTION** statements that are also applicable to that instruction.
R (b)**WARNING** statements that are applicable to an entire (full) procedure will follow the procedure title, and will precede all **CAUTION** or **NOTE** statements that are also applicable to the entire procedure.
R (2)**CAUTION :**
R **A CAUTION** statement tells the operator that damage to the part, engine, or equipment is possible if the operator does not obey the specified instruction.
R (a)**CAUTION** statements that are applicable to an instruction will precede the instruction and will follow all **WARNING** statements that are also applicable to that instruction.
R (b)**CAUTION** statements that are applicable to an entire procedure will follow the procedure title and all **WARNING** statements that are also applicable to the entire procedure, and will precede all **NOTE** statements that are also applicable to the entire procedure.
R (3)**NOTE :**
R **A NOTE** statement gives explanations and added information (data) that help the operator to do the specified instruction.
R (a)**NOTE** statements that are applicable to an instruction will follow the instruction.
R (b)**NOTE** statements that are applicable to an entire procedure will follow the procedure title and all **WARNING** and **CAUTION** statements that are applicable to the entire procedure.
R (c)In some procedures that are not new, it is possible that a **NOTE** statement will include instructions or dimensional limits (for example, feature controls). If a **NOTE** statement includes instructions or dimensional limits, then it is necessary to obey this information because it is necessary to complete the procedure.

R 2. Precautionary Measures To Be Taken During Removal/Installation

A. Reason For the Job
Use this task for general disassembly and assembly instructions.

B. Equipment and Materials

ITEM	DESIGNATION
(1)	Caps
(2)	Magnet
(3)	Other Covers
(4)	Plugs
(5)Material No.P05-012	Special Materials (Ref. 70-00-00)
(6)Material No.P05-255	Special Materials (Ref. 70-00-00)
(7)Material No.P06-038	Lubricants (Ref. 70-00-00)

C. Procedure - General Parts Removal Instructions
(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
WARNING : OPERATORS MUST OBEY ALL LOCAL REGULATIONS AND EMPLOYER WORK POLICIES WHEN THEY TOUCH OR DISCARD PARTS THAT CONTAIN ASBESTOS.
(2)Parts that contain asbestos
(a)At one time, some engine parts contained asbestos fibers, and it is possible that some of these parts continue in service. Refer to the commercial engine Service Bulletins for a list of parts that once contained asbestos.
(b)In some parts, the material that contains asbestos may be within an adhesive. It is important to use correct precautions during work with these parts.
(c)The asbestos used in Pratt & Whitney engine parts was usually encapsulated and will not release dust unless the parts are ground, sanded, drilled, scraped, cut or broken. While it is our experience that these operations do not usually generate asbestos at levels greater than permitted exposure limits, operators must use all applicable precautions when they touch such parts.
(3)Put tags and marks on all parts with their engine locations at the time of removal. This will make sure of the correct subsequent installation.
(4)Examine all parts for indications of cracking, scoring, burning or other damage at the time of removal.
(a)Put a tag on any unserviceable parts for subsequent investigation and possible repair.
CAUTION : IF YOU USE DUST CAPS FOR THE CONTAMINATION PROTECTION OF OPEN LINES, ALWAYS BE SURE TO INSTALL THE CAPS AROUND THE TUBE ENDS AND NOT IN THE TUBE ENDS. THERE CAN BE BLOCKAGE OF THE FLOW THROUGH THE TUBES IF THESE TUBES ARE INSTALLED ACCIDENTALLY WITH DUST CAPS IN THE TUBE ENDS.
(5)Do not permit dust, dirt, safety wire, safety cable, nuts, washers or other unwanted material (foreign objects - FOD) to go into the engine. Use the applicable plugs, caps and other covers to all openings as soon as possible during the disassembly process to prevent contamination.
(6)Foreign Objects

CAUTION : DO NOT PUT TOOLS, FASTENERS OR OTHER SMALL OBJECTS IN THE AREA BETWEEN THE INNER FAN EXIT CASE STRUTS. THESE OBJECTS CAN FALL THROUGH THE BLEED VALVE PORTS, INTO THE ENGINE AND CAUSE DAMAGE.

(a) If a part, tool or object falls into the engine, the assembly process must stop until the fallen articles are found. Before you assemble or install any part, make sure that it is fully clean.

(b) It is possible to find and remove a fallen object with a fiber optic scope. Attach a small plastic tube (approximately 0.375 to 0.500 in. (9.50 to 12.7 mm) diameter) to the side of the fiber optic scope with Masking Tape (Material No.P05-255) at several locations. Make sure that the end of the tube is aligned with the end of the fiber optic scope and it does not decrease movement of the scope. Attach other end of the plastic tube to a vacuum cleaner hose. Hold the object for removal by the suction of the plastic hose.

(c) If the above equipment is not available, it is possible to use a magnet to remove objects if they are magnetic. Attach the magnet to a flexible cable with Masking Tape (Material No.P05-255) so that it is possible to move it across a larger area. You can also use Double Sided Adhesive Tape Material No.P05-012) attached to the end of a flexible cable.

(7) Do not use safety wire, lockwashers, tablocks, key washers (tab type) or cotter pins again after they are removed. All safety wire and cotter pins must have a tight fit in their holes. Refer to Installation of Safety Wire (Ref 70-00-00, P. Block 201) and Installation of Safety Cable (Ref. 70-00-00, P. Block 201). Refer to Installation of Key Washers (Ref. 70-00-00, P. Block 201). Refer to Installation of Cotter Pins (Ref. 70-00-00, P. Block 201).

(a) Safety bushing plugs with lockwire to the assembly boss or case. Do not safety the plug to the bushing with lockwire.

(8) Discard all gaskets, packings and rubber parts at each removal. Replace all gaskets, packings and rubber parts with new ones at each installation. Make sure that new nonmetallic parts (such as oil seals) show no signs of deterioration from storage. Refer to Installation of Preformed Packings (Ref. 70-00-00, P. Block 201).

(9) If necessary, apply the applicable gasket lubricant to the gasket surfaces to prevent a bond of the gasket to the surfaces of the mating part as specified in the installation task. Refer to Application of Gasket Lubricant (Ref. 70-00-00, P. Block 201).

CAUTION : BEFORE YOU USE TOOLS WITH A LAYER OF PROTECTIVE MATERIAL, MAKE SURE THAT THERE IS SUFFICIENT PROTECTIVE MATERIAL TO PREVENT DAMAGE TO ENGINE PARTS.

(10) To give protection to the critical areas of engine parts (such as compressor and turbine disks) against scratches and nicks, tool surfaces which touch these areas must have a protective material cover.

(11) If parts have a layer of corrosion preventive compounds, remove all of this compound and all other foreign material before installation.

(12) For bolts, brackets, nuts and nut plates that are treated with molybdenum disulfide type dry film lubricants, such as Antigallant Compound (Material No.P06-038), it is possible that the parts may show yellowish white residue after thermal exposure. This occurs because the molybdenum disulfide lubricant in the antigallant oxidizes to a molybdenum trioxide

compound. The molybdenum trioxide is not detrimental to the structural integrity or functionality of the parts. Pratt & Whitney laboratory analysis has also demonstrated that this compound is not corrosive.

D. Storage of Kevlar-Wrapped Fan Containment Cases

CAUTION : IF ENGINES WITH KEVLAR-WRAPPED FAN CONTAINMENT CASES DO NOT HAVE COVERS TO KEEP OUT PRECIPITATION, THE RESULT CAN BE WATER ABSORBED INTO THE KEVLAR. THIS WATER IN THE KEVLAR WILL MAKE A KEVLAR BELT REPLACEMENT REPAIR NECESSARY. SUCH A REPAIR IS VERY EXPENSIVE AND TIME-CONSUMING.

(1)During engine transport and during short-term storage outdoors before engine transport or induction into a shop, it is important to put the correct covers on engines to keep out rain, snow, sleet, or hail.

R 3. Installation of Preformed Packings

A. Equipment and Materials

ITEM	DESIGNATION
(1)Material No.P03-001	Oils (Ref. 70-00-00)
(2)Material No.P06-002	Lubricants (Ref. 70-00-00)
(3)Material No.P06-053	Lubricants (Ref. 70-00-00)

B. Procedure - Necessary Lubricant Instructions

NOTE : Preformed rubber O-ring packings are referred to as packings.

(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2)Apply the correct lubricant to each packing before engine assembly as follows.

CAUTION : APPLY A THIN FILM OF LUBRICANT ON PACKINGS BEFORE INSTALLATION. CORRECT LUBRICATION AND ASSEMBLY WILL HELP PREVENT DAMAGE TO THE PACKING THAT CAN CAUSE ENGINE DAMAGE OR A SHUTDOWN.

CAUTION : DO NOT APPLY PETROLATUM TO PACKINGS USED IN FUEL OR OIL SYSTEMS. PETROLATUM DOES NOT DISSOLVE EASILY IN FUEL OR OIL AND CAN CAUSE BLOCKAGES IN SMALL PASSAGES AND CLOGGED FILTERS. CORRECT LUBRICATION AND ASSEMBLY WILL PREVENT DAMAGE TO THE PACKING THAT CAN CAUSE ENGINE DAMAGE OR A SHUTDOWN.

(a)Find the material specification of the packing. This is often shown on the package.

(b)Determine the type of system (fuel, oil or air) where the packing will be installed.

(c)Refer to Table 201 and select the necessary lubricant.

(d)Apply the necessary lubricant to each packing.

Engine System	Packing Material	Material Specification	Lubrication Specification
Fuel	Fluorosilicone	AMS 7273	Engine Oil (Material No.P03-001) or Lubricant (Material

Engine System	Packing Material	Material Specification	Lubrication Specification
			No.P06-053)
Oil or Fuel	Fluorocarbon	AMS 7276, AMS 7278, AMS 7280	Engine Oil (Material No.P03-001) or Lubricant (Material No.P06-053)
Air or Water	Silicone	AMS 3301, AMS 3302, AMS 3303, AMS 3304, AMS 3305, AMS 3315, AMS 3320, AMS 3332, AMS 3334, AMS 3335, AMS 3336, AMS 3338, AMS 3345, AMS 3346, AMS 3356, AMS 3357, AMS 7267	White Petrolatum (Material No. P06-002) See NOTE 1.

Packing Lubricant
Table 201

NOTE : Use only a small amount of White Petrolatum (Material No.P06-002) on Silicone packings used in air systems. Hot air can move this lubricant into downstream components and cause contamination. Never use Engine Oil (Material No.P03-001) on Silicone packings.

C. Instructions for the Installation of Preformed Packings
(1)Always use new packings at each assembly.
(2)Check the package for a date. This date is called the shelf life.
(3)Do not use packings that have gone past the shelf life date.
(4)If there is no date on the package, there is no shelf life.
(5)Apply a layer of specified lubricant to the O-ring before assembly.
NOTE : Use only the lubricants specified for the O-ring preformed packing material and be sure that the O-ring has the lubricant material fully on it.
(6)Do a visual inspection of the O-ring mating surfaces and all other surfaces that the O-ring will touch during installation. Be sure that there is no damage or sharp edges that could cause damage to the seal during installation or that could cause a leak.
(7)Push or slide the packing into position. Do not twist or roll the packing when it is installed.
(8)Do not install packings on engine parts which are hot (hot parts will cause damage to a packing).
(9)Use an approved tool to install the packings on a part which has more than one packing groove (this is to prevent damage to the packing).
(10)To be sure not to accidently cut a packing, correctly align the mating parts when you assemble them. Always push parts with packings straight on to the mating part when they are installed. This will make sure that

the part does not twist as it is installed and will prevent subsequent damage to the packing.

R 4. Check for Reuse of Self-Locking Fasteners

A. Equipment and Materials

ITEM	DESIGNATION
(1)	Torque Wrench

B. Procedure - General
(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
(2)To identify the hardware material (composition), refer to Hardware Material Identification (Ref. 70-00-00, P. Block 201).
(3)Self-Locking fasteners are designed for a limited number of reuses to keep the quality of their self-locking function.
(4)Discard the fastener if the self-locking function is not correct.
(5)Do not try to repair a fastener in this condition.

C. Torque Limit
(1)Before you use a self-locking fastener again, test the self-locking function of fasteners by one or more of the methods which follow.
(a)Use a torque wrench to test each part and compare to the values specified in Table 201.
(b)Use feel to test each part during the final assembly by the assembly mechanic.
NOTE : If the above method is used, the assembly mechanic must get training in the usual or new part feel of the applicable fasteners. If the mechanic finds excessive torque looseness or torque drag during the installation of a fastener, replace the fastener with one which is acceptable as specified in Table 201.
(c)Discard the fastener and replace with a new part.
(2)Use Table 201 for prevailing torque-type locknuts or helical coil inserts and self-locking bolts or screws.
(a)Test the torque with the self-locking feature fully engaged and the fastener unseated so that only the frictional hold on the screw thread is measured for the breakaway and locking (drag) torques.
(b)Minimum breakaway torque
1 This is the minimum torque necessary to initially turn an installed nut on a bolt, or a bolt in a self-locking nut or helical coil insert.
2 The minimum breakaway torque must not be less than the value given.
(c)Maximum locking torque
1 This is the torque necessary to continuously turn a loosened nut on a bolt, or a bolt in a self-locking nut or helical coil insert.
2 The maximum locking torque must not be more than the given value.

Thread Size	Minimum Breakaway Torque lbf.in. (m.daN)	Maximum Locking (Drag) Torque lbf.in. (m.daN)
0.112 - 40	0.5 lbf.in. (0.006 m.daN)	3.0 lbf.in. (0.034 m.daN)
0.112 - 48	0.5 lbf.in. (0.006 m.daN)	3.0 lbf.in. (0.034 m.daN)
0.138 - 32	1.0 lbf.in. (0.011 m.daN)	6.0 lbf.in. (0.068 m.daN)
0.138 - 40	1.0 lbf.in. (0.011 m.daN)	6.0 lbf.in. (0.068 m.daN)
0.164 - 32	1.5 lbf.in. (0.017 m.daN)	9 lbf.in. (0.102 m.daN)
0.164 - 36	1.5 lbf.in. (0.017 m.daN)	9 lbf.in. (0.102 m.daN)
0.190 - 24	2.0 lbf.in. (0.023 m.daN)	13 lbf.in. (0.147 m.daN)
0.190 - 32	2.0 lbf.in. (0.023 m.daN)	13 lbf.in. (0.147 m.daN)
0.250 - 20	4.5 lbf.in. (0.051 m.daN)	30 lbf.in. (0.340 m.daN)
0.250 - 28	3.5 lbf.in. (0.040 m.daN)	30 lbf.in. (0.340 m.daN)
0.3125 - 18	7.5 lbf.in. (0.085 m.daN)	60 lbf.in. (0.068 m.daN)
0.3125 - 24	6.5 lbf.in. (0.073 m.daN)	60 lbf.in. (0.068 m.daN)
0.375 - 16	12.0 lbf.in. (0.136 m.daN)	80 lbf.in. (0.904 m.daN)
0.375 - 24	9.5 lbf.in. (0.107 m.daN)	80 lbf.in. (0.904 m.daN)
0.4375 - 14	16.5 lbf.in. (0.186 m.daN)	100 lbf.in. (1.130 m.daN)
0.4375 - 20	14 lbf.in. (0.158 m.daN)	100 lbf.in. (1.130 m.daN)
0.500 - 14	24 lbf.in. (0.271 m.daN)	150 lbf.in. (1.695 m.daN)
0.500 - 20	18 lbf.in. (0.203 m.daN)	150 lbf.in. (1.695 m.daN)
0.5625 - 12	30 lbf.in. (0.339 m.daN)	200 lbf.in. (2.260 m.daN)
0.5625 - 18	24 lbf.in. (0.271 m.daN)	200 lbf.in. (2.260 m.daN)
0.625 - 11	40 lbf.in. (0.452 m.daN)	300 lbf.in. (3.390 m.daN)
0.625 - 18	32 lbf.in. (0.362 m.daN)	300 lbf.in. (3.390 m.daN)
0.750 - 10	60 lbf.in. (0.678 m.daN)	400 lbf.in. (4.520 m.daN)
0.750 - 16	50 lbf.in. (0.565 m.daN)	400 lbf.in. (4.520 m.daN)
0.875 - 9	82 lbf.in. (0.927 m.daN)	600 lbf.in. (6.779 m.daN)
0.875 - 14	70 lbf.in. (0.791 m.daN)	600 lbf.in. (6.779 m.daN)
1.000 - 8	110 lbf.in. (1.243 m.daN)	800 lbf.in. (9.039 m.daN)
1.000 - 14	92 lbf.in. (1.040 m.daN)	800 lbf.in. (9.039 m.daN)

Torques For Reuse of Fasteners
Table 201

R 5. Key Washers

A. Installation of Key Washers (Tab-Type)
(1)Equipment and materials

ITEM	DESIGNATION
R (a)Material No.P05-018	Special Materials (Ref. 70-00-00)

(2)Procedure - General instructions
(a)Always obey the specific procedures and limits in the specific AMM

maintenance tasks.
(b)Some key washers are pre-bent at manufacture.
(c)Use key washers only one time. Use a new key washer for each installation.
(d)Use the correct key washers as specified by the specific AMM maintenance task.

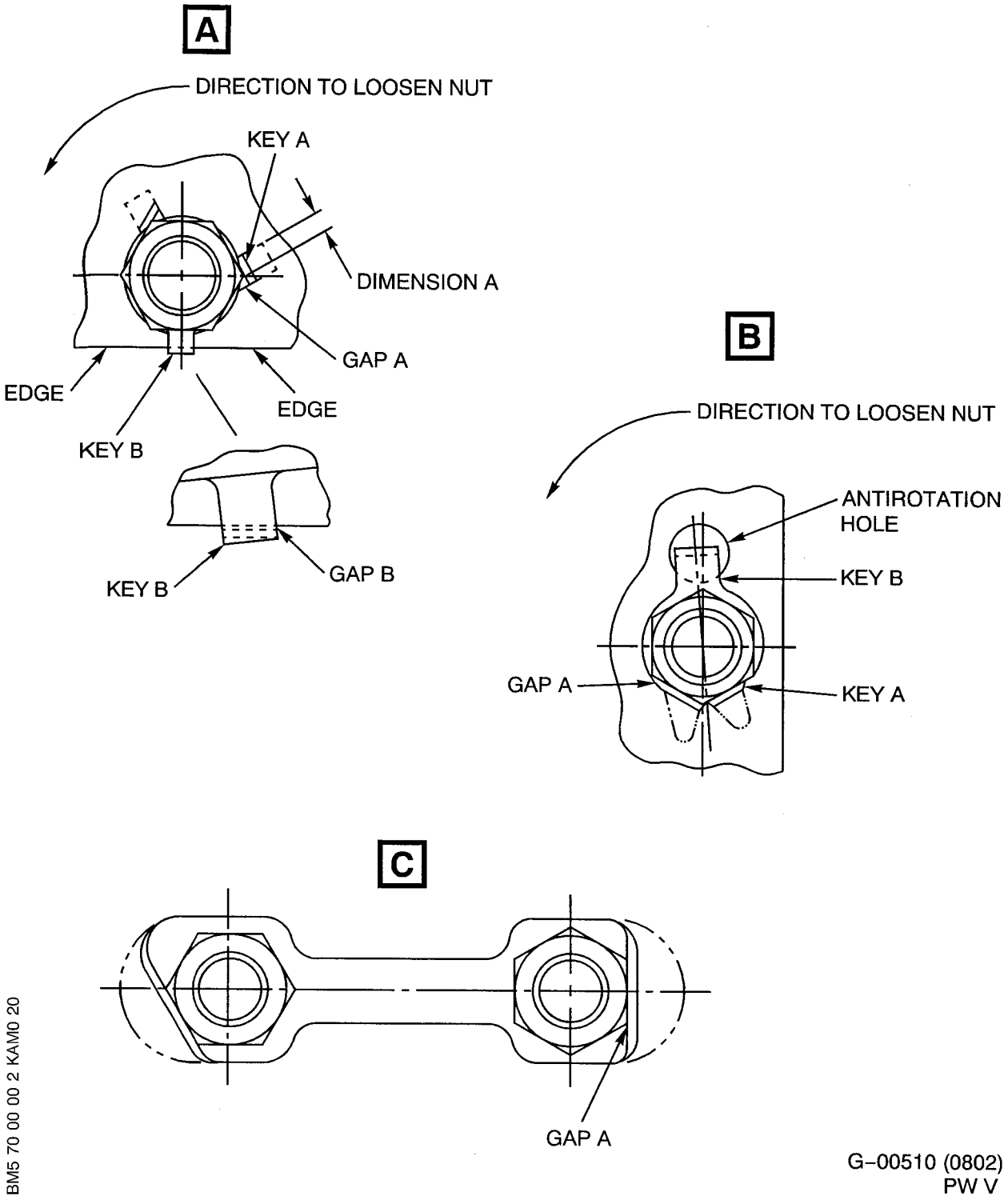
(3)Procedure
(a)Install key washers as follows (Ref. Fig. 201).
1 Install the key washer so that the unbent keys are as far as possible from the axis of the part to be locked.
2 The pre-bent key (Key B) must be tight to the overhanging surface as shown or put against the side of the hole to prevent possible movement of the locked part.
3 When you torque the fastener and bend the key washer, you must keep the key washer in the same position.
4 If necessary, use a Pencil (Material No.P05-018) or any marker as specified in Marking Parts (Ref. 70-00-00, P. Block 201). Mark the parts so that you can detect any turn of the key washer during the torque of the nut.
5 Hold the key washer against the antirotation surface in the loosen direction while you torque the fastener to the torque specified by the AMM task.
6 Examine the pre-bent key (Key B) to make sure that it is not damaged.
7 For pre-bent keys (Key B) that use a surface edge for antirotation, make sure that the gap between the key (Key B) and the surface is 0.020 in. (0.508 mm) or less.
a You can bend the pre-bent key (Key B) at installation to meet the gap limits.
8 Carefully bend all keys (Keys A) on the key washer so that it cannot be used again and that you do not cause cracks, gouges or other damage.
9 Bend at least one key (Key A) so that 75 percent or more of its width (as measured at the base of the key) engages the flat of the fastener (Dimension A).
10 Bend all the keys (Keys A) so that the gap is within the limits which follow.
a For fastener threads 0.3125 in. (7.938 mm) or less, Gap A is 0.010 in. (0.254 mm) or less.
b For fastener threads more than 0.3125 in. (7.938 mm), Gap A is 0.020 in. (0.508 mm) or less.
(b)Install elliptical key washers as follows.
1 After you torque the fasteners, bend the washer up across one whole face of the hexagon.
a For fastener threads 0.3125 in. (7.938 mm) or less, Gap A is 0.010 in. (0.254 mm) or less.
b For fastener threads more than 0.3125 in. (7.938 mm), Gap A is 0.020 in. (0.508 mm) or less.
(c)The previous requirements for key washers and elliptical key washers are applicable to the keys for each hole in a multiple-hole key washer.

(d)Key washers used with fuel nozzle nuts must not have the keys bent by impact.
(e)Examine the installed key washer as follows.
1 Make sure that a new key washer was installed.
2 Make sure that the keys are bent as previously specified.
3 Make sure that the keys are bent so that the key washer and fastener cannot move or turn to loosen.
4 Scoring, gouging and smearing of the key washer or adjacent parts are not permitted.
5 Small tool marks from usual forming and bending procedures are permitted.

B. Installation of Key Washers (Cup-Type)
(1)Equipment and materials

	ITEM	DESIGNATION
R	(a)Material No.P05-018	Special Materials (Ref. 70-00-00)

(2)Procedure - General instructions
(a)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
(b)Some key washers are pre-bent at manufacture.
(c)Use key washers only one time. Use a new key washer for each installation.
(d)Use the correct key washers as specified by the specific AMM maintenance task.
(e)Crimping tools
1 Tool requirements
a The portion of the tool that forms the indentations must be spherically shaped and have a spherical radius of not less than 0.050 in. (1.270 mm).
2 Squeeze action tool
a This tool forms indentations by pressing the cup-type key washer into slots in the nut or bolt. This type of tool is recommended and must be used where possible.
3 Drift type tool
a This tool consists of a ring with prongs on the inside diameter. This tool, when put over the cup-type key washer and moved in an axial direction, will form indentations on the outside diameter of the cup-type key washer.
4 Punch
CAUTION : CUP-TYPE KEY WASHERS USED WITH FUEL NOZZLE NUTS MUST NOT HAVE THE INDENTATIONS FORMED BY IMPACT. IF YOU DO NOT OBEY THIS CAUTION, DAMAGE TO THE FUEL NOZZLE CAN OCCUR.
a This tool will form indentations on the outside diameter of the cup-type key washer by the impact of the tool with a hammer.
(3)Procedure
(a)Position control to prevent broken or bent tabs
CAUTION : USE THE CORRECT MARKING PEN OR PENCIL. IF YOU DO NOT, THE MARK CAN HAVE A HARMFUL EFFECT ON THE MATERIALS.



Installation of Key Washers (Tab-Type)
Figure 201

1 To prevent broken or bent key washer tabs, you must mark the position of the cup-type key washer to the adjacent surface before you tighten and torque the nut.

2 Use a Pencil (Material No.P05-018) or any marker as specified in Marking Parts (Ref. 70-00-00, P. Block 201). Mark the parts so that you can detect any turn of the key washer during the torque of the nut.

(b)Required number of indentations

1 For cup-type key washers, you must bend the key washer in two or more places to give sufficient interference with the nut so that the nut will not turn ((Ref. Fig. 202) for requirements).

2 After you tighten and torque the nut, you must indent the cup-type key washer in the correct number of places. Refer to Table 201 unless specified differently.

3 If the number of rounded slots in the nut or bolt is less than the necessary amount of indentations, the requirements of Table 201 do not apply.

4 If the key washer is the type shown in Figure (Ref. Fig. 202) (Sheet 2), the requirements of Table 201 do not apply.

Thread Size	Number of Indentations	Spacing Between Indentations
Less than 1.500 in. (38.100 mm)	2	(#)
1.500 in. (38.100 mm) to less than 2.500 in. (63.500 mm)	4	60 dia - 120 dia
2.500 in. (63.500 mm) to less than 4.000 in. (101.600 mm)	6	6 slot nut 45 dia - 75 dia
	6	8 slot nut 45 dia - 90 dia (#)
4.000 in. (101.600 mm) and larger	8	30 dia - 60 dia

(#) See Figure (Ref. Fig. 202) (Sheet 1) for indentation spacing.

Required Number of Indentations
Table 201

5 For the cup-type key washers shown in Figure (Ref. Fig. 202), you must make the indentations as shown.

(c)Key washer engagement

Thread Size	B Reference	C Minimum (**) Engagement
0.190 in. (4.826 mm)	0.043 in. (1.092 mm)	0.026 in. (0.660 mm)
0.250 in. (6.350 mm)	0.042 in. (1.067 mm)	0.025 in. (0.635 mm)
0.3125 in. (7.938 mm)	0.040 in. (1.016 mm)	0.024 in. (0.610 mm)
0.375 in. (9.525 mm)	0.039 in. (0.991 mm)	0.023 in. (0.584 mm)

(**) C Minimum = 0.6 B

Required Engagement Measurements For Cup-Type Key Washers
Table 202

(d)Examine the installed key washer as follows.
1 Make sure that a new key washer was installed.
2 Make sure the key washer is not loose and cannot shake or rattle.
3 Make sure the cup is bent as previously specified.
4 Make sure the key washer did not move during the assembly.
5 If there is no axial pinch on the diaphragm portion of the key washer, you can move the washer by hand through the limits of the tab clearance.
6 Cracking, tearing, scoring, gouging and smearing of the key washer or adjacent parts are not permitted.
7 Small tool marks from usual forming and bending procedures are permitted.
8 Indentations in one key washer must be of similar size and shape.
9 Indentations in the key washer must be formed into the rounded slots in the nut where the nut has such slots.

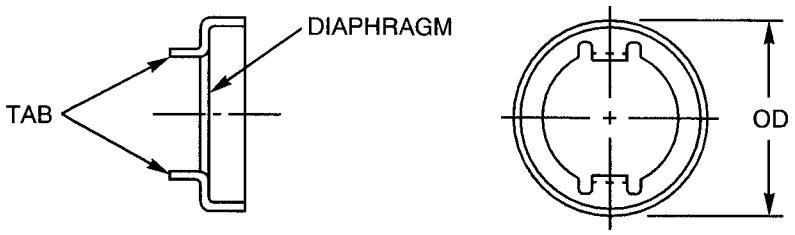
R 6. Installation of Safety Wire

NOTE : The nomenclatures lockwire and safety wire are interchangeable.

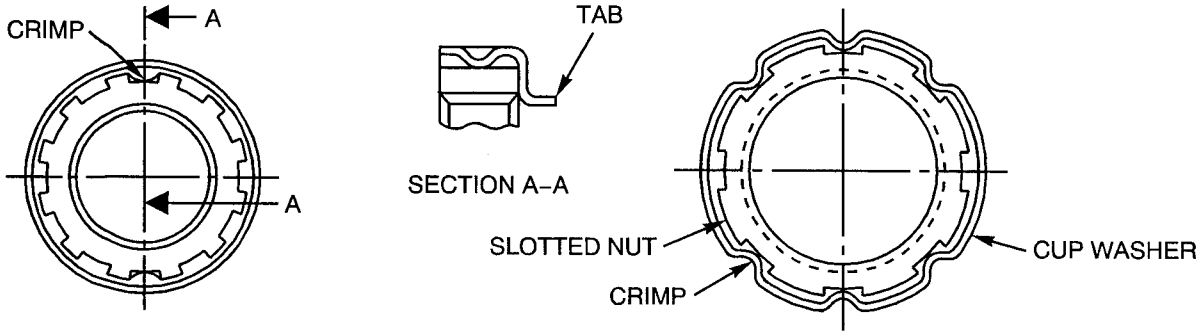
A. Reason for the Job

R (1)The instructions that follow fully satisfy PWA 316 Safety Wire
R (Lockwire) Installation instruction procedures for fasteners, which
R include :
R (a)Bolts, screws, nuts.
R (b)Tube coupling nuts, hose connectors, jamnuts.
R (c)Electrical connectors.
R (d)Lead seals.

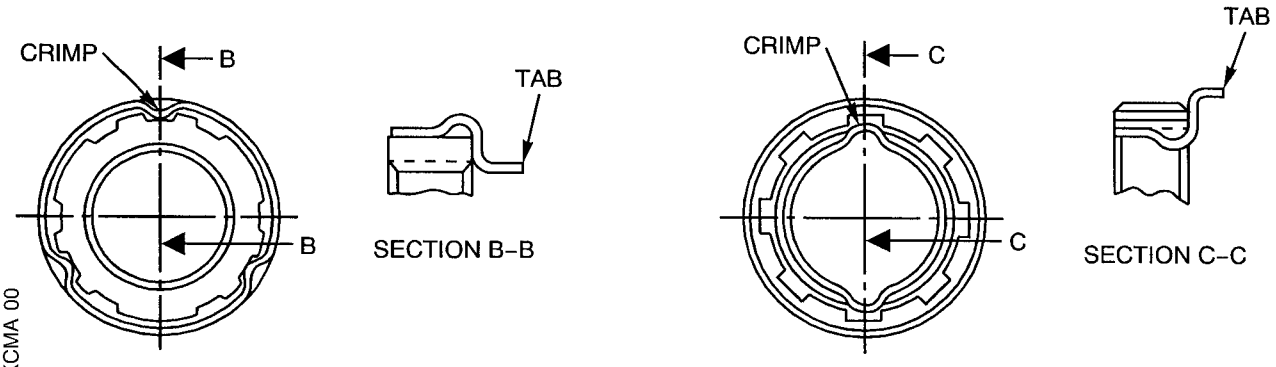
B. Equipment and Materials



TYPICAL CUT-TYPE
KEYWASHER



CRIMPING



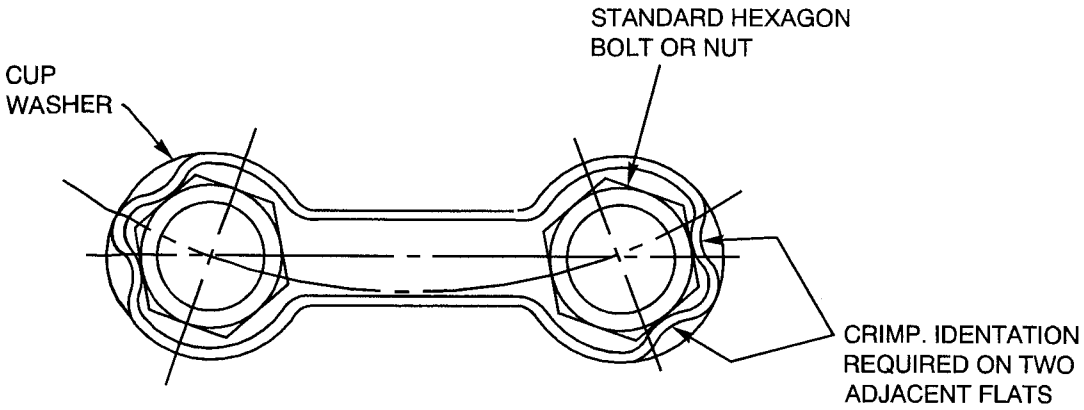
EXTERNAL CRIMP

INTERNAL CRIMP

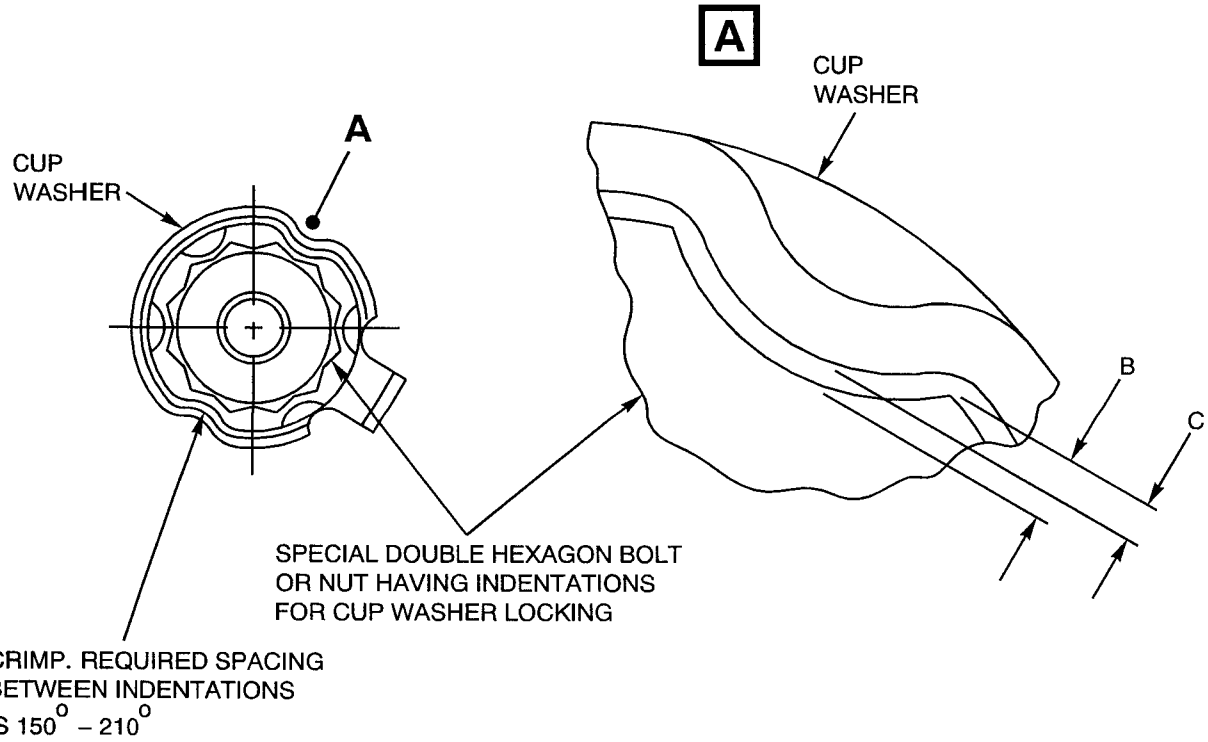
BM5 70 00 00 2 KCMA 00

G-11808 (1002)
PW V

Installation of Key Washers (Cup-Type) (Sheet 1/2)
Figure 202



MULTI-HOLE CUP-TYPE CRIMP



SINGLE TAB CUP-TYPE
DIMPLE ENGAGEMENT

BM5 70 00 00 2 KCMM 00

G-11809 (0203)
PW V

Installation of Key Washers (Cup Type) (Sheet 2/2)
Figure 202

ITEM	DESIGNATION
(1)	Pliers, Wire Twisters
(2)	Lockwire (as specified by the specific AMM maintenance task)

C. Procedure - General Specifications
(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
R (2)The terms safety wire and lockwire are interchangeable. Safety wire is
R the newer term. Thus, the remaining text will use the newer term.
R (3)In commercial engine assembly procedures, P&W used different types of
R safety wire over the years.
R (a)MS9226 (AMS 5687) and MS20995N (NASM20995) safety wires are Inconel
R 600 nickel safety wires, which are stiff and difficult to work with.
R (b)AS3214 (AMS 5689, AISI 321) safety wire is a stabilized stainless steel
R safety wire that is not as stiff as the Inconel 600 wires and thus
R is easier to work with.
R (c)MS20995C (NASM20995) and AMS 5697 are 304-series stainless steel
R safety wires that are used in applications where the temperatures are
R below 700°F (371°C).
R (4)Use the correct safety wire as specified in the specific AMM maintenance task.
R (5)Obey the maximum safety wire length limits which follow.
(a)The maximum length (span) of safety wire between two tension points is 6 in. (152.4 mm) maximum, unless specified differently by the specific AMM maintenance task.
(b)The maximum length of safety wire used to safety multiple fasteners together in a series (3 or 4) is 24 in. (609.6 mm) maximum, unless specified differently by the specific AMM maintenance task.
R (6)Obey the maximum number of fasteners in a series limits which follow.
(a)Do not safety more than four fasteners in a series with one continuous length of wire, unless specified differently by the specific AMM maintenance task.
(b)If there are more than four fasteners in a series and the text or illustration specifies "Safety Wire Together", do the steps which follow.
1 Divide this group into smaller groups of two, three or four fasteners.
2 Safety each of the smaller groups separately with safety wire.
3 Safety the smaller groups in series with each other with safety wire.

D. Procedure
(1)Torque the parts before you install the safety wire as follows (Ref. Fig. 203).
(a)All fasteners must be correctly torqued before you install the safety wire.
(b)For two or more fasteners safetied together, you must also put the wire holes in a correct position in relation to each other.

(c)To get the correct hole alignment, torque the fasteners to the limits for fasteners with wire holes (Ref. 70-00-00, P. Block 201).
(d)Do not decrease the torque less than the specified limit to correctly align the wire holes.
(e)Do not increase the torque more than the specified limit to correctly align the wire holes.
(f)If necessary, use another fastener or part to correctly align the wire holes within the specified torque limits.

(2)Select the number of strands of the safety wire as follows.
(a)Use two strands of safety wire twisted together (double-twisted), unless specified differently by the specific AMM maintenance task.
(b)Use a single strand safety wire only where specified by the specific AMM maintenance task.

(3)Examine the safety wire holes as follows.
CAUTION : DO NOT INSTALL THE SAFETY WIRE IN HOLES WITH BURRS OR SHARP EDGES. IF YOU DO, THE SAFETY WIRE CAN BREAK DURING ENGINE OPERATION.
(a)Examine the safety wire holes for burrs or sharp edges.
(b)Remove the burrs or sharp edges from the safety wire holes.
(c)If necessary, replace the parts with burrs or sharp safety wire holes.

(4)Examine the safety wire pliers as follows.
(a)Examine the jaws of the safety wire pliers for sharp edges or corners.
(b)If necessary, round off the sharp pliers jaws and make smooth.
NOTE : This will prevent nicks and damage to the safety wire.

(5)Determine the direction and pattern of the safety wire for the parts that must be safetied (Ref. Fig. 204).
NOTE : The Figure given below (Sheets 1 through 5) does not show every possible combination of parts that can be safety wired. Use these figures as a guide for other applications (Ref. Fig. 204).
(a)Install safety wire for a group of three bolts or screws as shown in Examples 3 through 6.
(b)Install safety wire for a group of two bolts or nuts with the wire wrapped over the top of a bolt or nut as shown in Examples 7 and 8.
1 Use this method if there is little or no clearance around the bolt or nut.
(c)Install safety wire for a square plug to a lug with a safety wire hole as shown in Example 9.
(d)Install safety wire for a single screw to a lug with a safety wire hole as shown in Example 10.
(e)Install safety wire for two bolts that are on a different plane as shown in Example 11.
(f)Install safety wire for hollow head plugs as shown in Examples 12 through 14.
(g)Install a single strand of safety wire for multiple screws as shown in Example 15.
(h)Install safety wire wrapped around an adjacent bracket for a bolt as shown in Examples 16.
1 Use this method to safety any part if there is no lug with a safety wire hole.
(j)Install safety wire for tube and hose nuts or electrical connectors as shown in Examples 17 and 18.

(k)Install safety wire for tube and hose nuts or electrical connectors with a lug with a safety wire hole as shown in Examples 19 and 20.
(l)Install safety wire for tube and hose nuts or electrical connectors without a lug with a safety wire hole as shown in Examples 21 and 22.
(m)Install safety wire for small tube nuts or nuts made of soft material as shown in Example 23.
1 Use this method for all nuts with a thin wall thickness at the safety wire holes.
2 Wrap the wire around the nut as shown to prevent a break through the thin wall section.
(n)Install safety wire for two adjacent tube and hose nuts or electrical connectors as shown in Example 24.
(p)Install safety wire for tube and hose nuts or electrical connectors to a lug with a safety wire hole as shown in Example 25.
(q)Install safety wire for a tube nuts on a tee as shown in Example 26.
(r)Install safety wire for a straight bulkhead tube nut to a bolt as shown in Example 27.
(s)Install safety wire for a tube nuts and jam nuts as shown in Examples 28 through 30.
(t)Install a lead seal to the end of the safety wire as shown in Examples 31 and 32.
1 Attach the seal at the end of the safety wire after the last item is safetied.
2 Wrap the loose end of the wire to the safety wire in front of the seal or to an empty safety wire hole.

(6)Install the safety wire as follows (Ref. Fig. 203).
(a)Install the safety wire so that it always applies tension to tighten the parts.
(b)Make sure that there is no additional tension on the wire other than the original tension.
(c)If the torque on the threaded part becomes reduced, do the steps that follow.
1 Remove the safety wire.
2 Tighten the fastener again to the specified torque limits.
3 Install the safety wire again.
(d)Obey all the assembly instructions if any slack is necessary between tension points.
(e)Pull the safety wire tight as you twist it and make the recommended number of twists. Refer to Table 201.

Wire Diameter in. (mm)	Twists/in. (25.4 mm)
0.015 - 0.017 in. (0.381 - 0.432 mm)	11 - 14
0.019 - 0.021 in. (0.483 - 0.533 mm)	9 - 13
0.024 - 0.026 in. (0.610 - 0.660 mm)	9 - 12
0.030 - 0.034 in. (0.762 - 0.864 mm)	7 - 10
0.038 - 0.042 in. (0.965 - 1.067 mm)	7 - 10
0.049 - 0.053 in. (1.245 - 1.346 mm)	5 - 8
0.061 - 0.065 in. (1.549 - 1.651 mm)	5 - 8

NOTE : One twist is a twist of the wires through an arc of 180 degrees, equal to half of a complete turn.

(f)Twist the wire to one-eighth inch (3.175 mm) distance from the safety wire hole.

(7)Trim off the unwanted safety wire as follows.

CAUTION : BE SURE THAT THE CUT WIRE ENDS DO NOT FALL INTO THE ENGINE. IF IT DOES, THE SAFETY WIRE CAN CAUSE DAMAGE DURING ENGINE OPERATION.

(a)Cut off the unwanted wire at the end of the last fastener and keep at least three full twists.

1 Do not twist off the end of the safety wire with the wire twist pliers.

2 You must use wire cutting pliers to cut off the end of the wire.

(b)Make sure that the safety wire does not have loose or non-twisted ends.

(c)Make sure that the safety wire does not have sharp ends.

(d)Bend the end of the wire in towards the part so that it does not point out.

NOTE : If the ends point out they could be a safety hazard to persons who work on the engine. They could also vibrate in the airstream during engine operation and break off.

(8)Examine the safety wire after installation as follows.

(a)Examine the safety wire for flex limits as follows.

1 Push on the safety wire at mid-span with light finger pressure, approximately 2 lbs (0.91 kg).

2 The total flex for the safety wire must not be more than the limits shown in the Figure (Ref. Fig. 205).

(b)Examine the safety wire for damage as follows.

CAUTION : BE SURE THAT THERE ARE NO CRACKS IN THE WIRE. IF IT DOES, THE SAFETY WIRE CAN BREAK AND CAUSE DAMAGE DURING ENGINE OPERATION.

1 Examine the wire for cracks or broken strands. Cracks or broken strands are not permitted.

2 Examine the wire for nicks, kinks or damage. Nicks, kinks or damage are not permitted.

3 Remove and replace the safety wire if you find any cracks, broken strands, nicks, kinks or damage.

4 Examine the safety wire for abrasions. Light abrasions from the safety wire pliers are permitted.

(c)Examine the safety wire for clearance as follows.

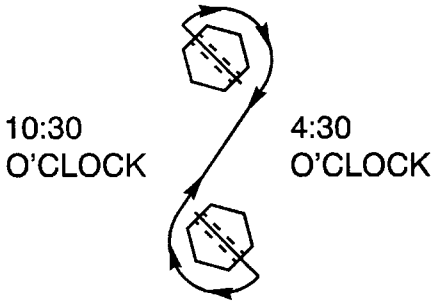
1 Examine the safety wire for clearance between all adjacent parts.

2 The wire must not touch, chafe or rub on adjacent parts during engine operation.

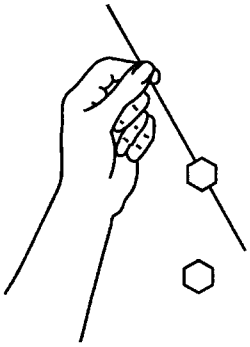
3 The wire must not stretch or get too much tension during engine operation.

4 The above limits apply for all parts that move during engine operation (examples are variable stator rings, bleed valves, actuators, control cables and linkage).

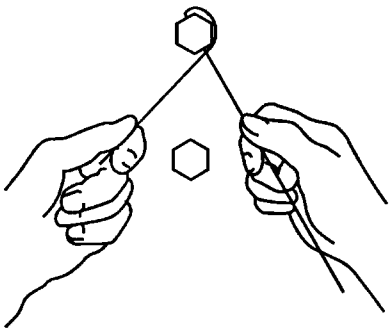
R 7. Installation of Safety Cable



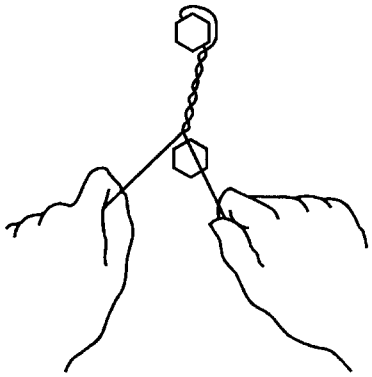
STEP 1
ALIGN THE SAFETY WIRE HOLES.



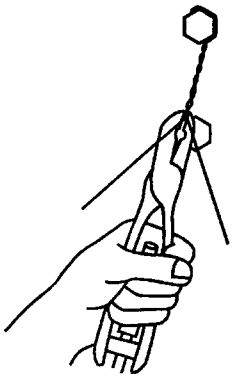
STEP 2
INSTALL THE CORRECT GAGE SAFETY WIRE.



STEP 3
BEND THE SAFETY WIRE AROUND THE BOLT HEAD



STEP 4
TWIST THE SAFETY WIRE UNTIL SAFETY WIRE IS JUST SHORT OF THE HOLE IN THE SECOND BOLT.

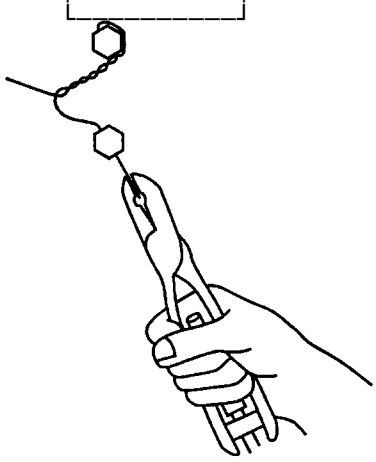


STEP 5
KEEP THE SAFETY WIRE UNDER TENSION AND TWIST IT IN A CLOCKWISE DIRECTION UNTIL THE SAFETY WIRE IS TIGHT.

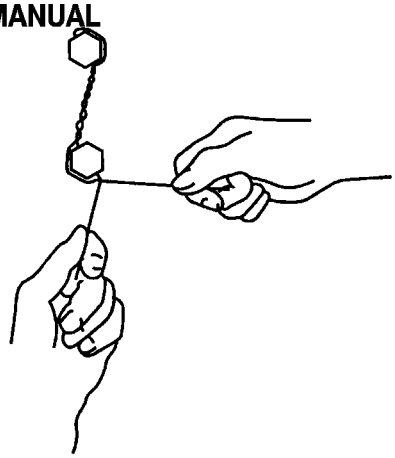
BM5 70 00 00 2 KEMA 00

G-11777 (0802)
PW V

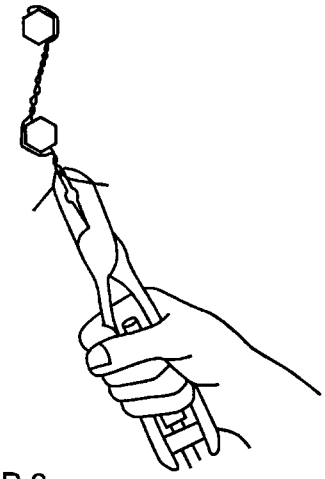
Installation of Safety Wire (Sheet 1/2)
Figure 203



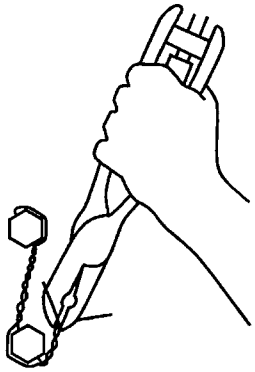
STEP 6
PUT THE UPPERMOST WIRE THROUGH THE SAFETY WIRE HOLE IN THE SECOND BOLT
PULL THE WIRE TIGHT WITH PLIERS.



STEP 7
BRING THE FREE END OF THE WIRE AROUND THE BOLT HEAD IN A COUNTERCLOCKWISE DIRECTION. TWIST THE TWO ENDS OF THE SAFETY WIRE IN A COUNTERCLOCKWISE DIRECTION.

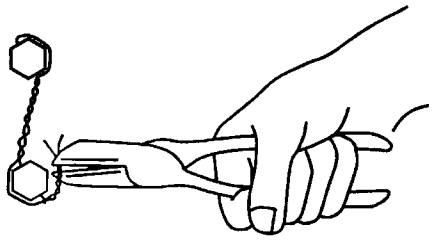


STEP 8
GRASP THE SAFETY WIRE BEYOND THE TWISTED PORTION AND TWIST THE SAFETY WIRE ENDS COUNTERCLOCKWISE UNTIL TIGHT.



STEP 9
DURING THE FINAL TWISTING MOTION OF THE PLIERS, BEND THE SAFETY WIRE DOWN AND UNDER THE HEAD OF THE BOLT.

BM5 70 00 00 2 KEMM 00

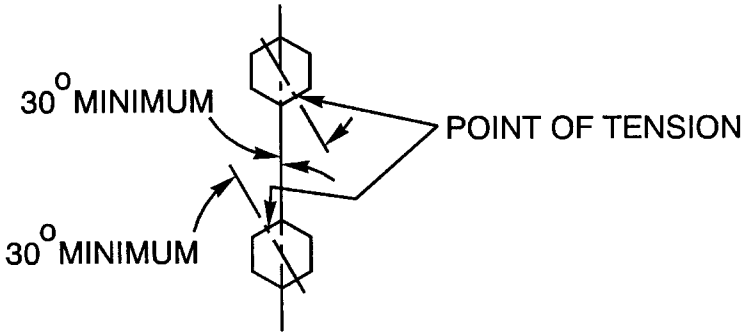


STEP 10
CUT OFF EXCESS SAFETY WIRE WITH DIAGONAL CUTTERS.

G-11778 (0802)
PW V

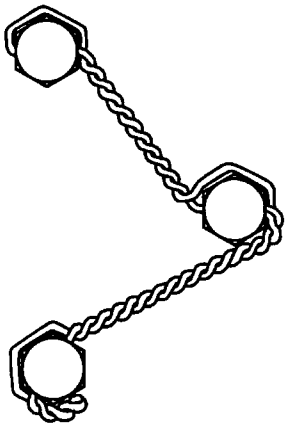
Installation of Safety Wire (Sheet 2/2)
Figure 203

EXAMPLE 1

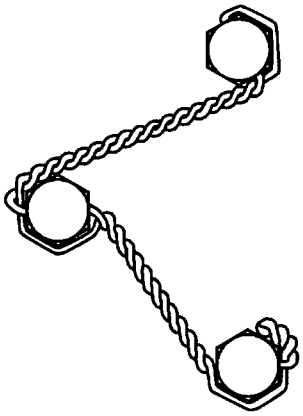


EXAMPLE 2

EXAMPLE 3

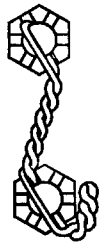


EXAMPLE 4



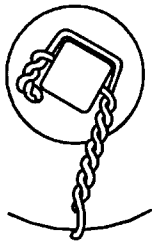
EXAMPLE 5

EXAMPLE 6

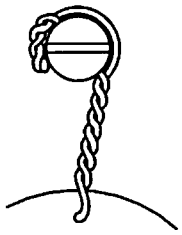


EXAMPLE 7

EXAMPLE 8



EXAMPLE 9

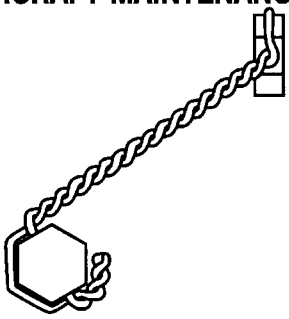


EXAMPLE 10

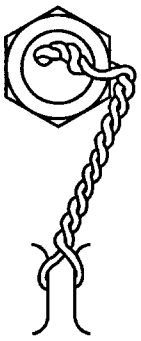
G-00499 (0802)
PW V

BM5 70 00 00 2 KGMA 00

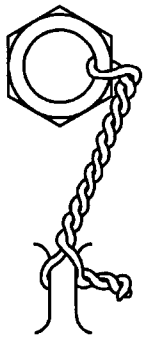
Installation of Safety Wire (Examples) (Sheet 1/5)
Figure 204



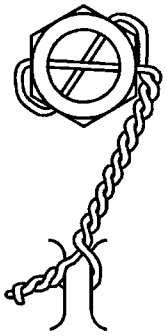
EXAMPLE 11
SAFETY WIRE OF BOLTS
THAT ARE IN DIFFERENT PLANES.



EXAMPLE 12



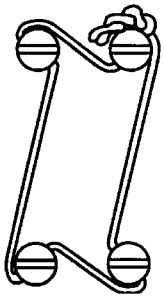
EXAMPLE 13



EXAMPLE 14

SAFETY WIRE OF HOLLOW HEAD PLUGS

EXAMPLE 12 IS THE RECOMMENDED
METHOD. EXAMPLES 13 AND 14 ARE
SATISFACTORY ALTERNATIVE METHODS.

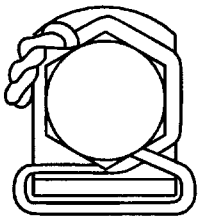


EXAMPLE 15
SAFETY WIRE METHOD WITH A SINGLE WIRE
FOR A CLOSELY SPACED MULTIPLE GROUP.

G-00500 (0802)
PW V

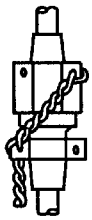
BM5 70 00 00 2 KGME 00

Installation of Safety Wire (Examples) (Sheet 2/5)
Figure 204

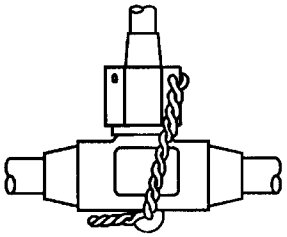


EXAMPLE 16

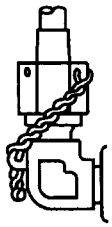
EXAMPLE 17



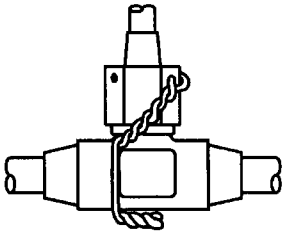
EXAMPLE 18



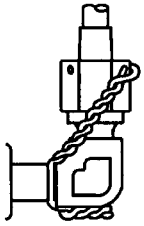
EXAMPLE 19



EXAMPLE 20



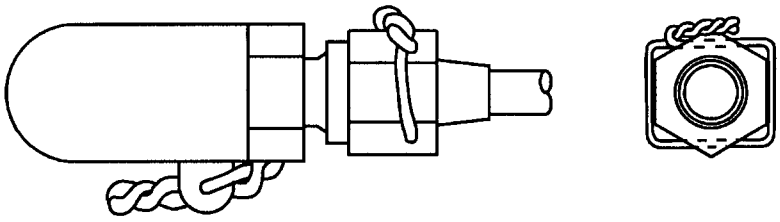
EXAMPLE 21



EXAMPLE 22

SAFETY WIRE METHOD FOR FITTINGS WITH SAFETY WIRE LUG.

SAFETY WIRE METHOD FOR FITTINGS WITHOUT SAFETY WIRE LUG.

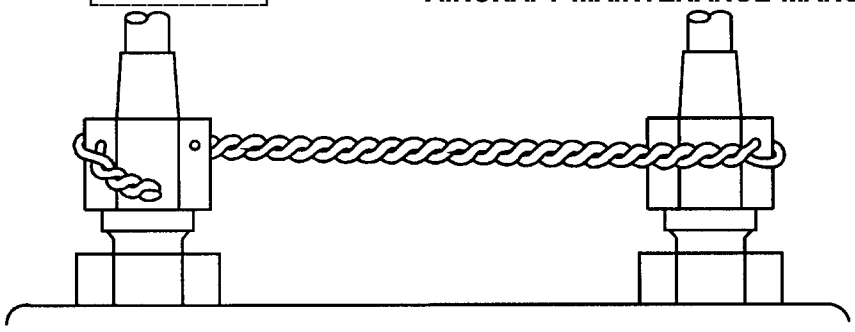


EXAMPLE 23
SAFETY WIRE METHOD FOR SMALL TUBE NUTS WITH THIN WALL THICKNESS

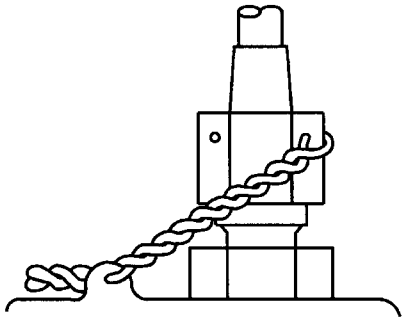
G-00501 (0802)
PW V

BM5 70 00 00 2 KGMJ 00

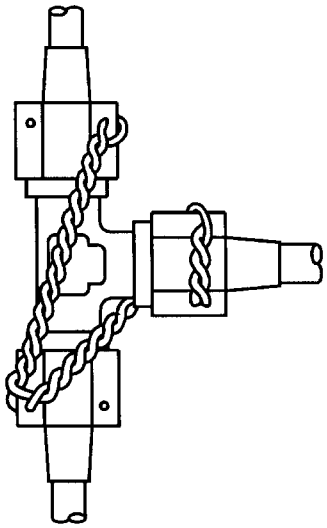
Installation of Safety Wire (Examples) (Sheet 3/5)
Figure 204



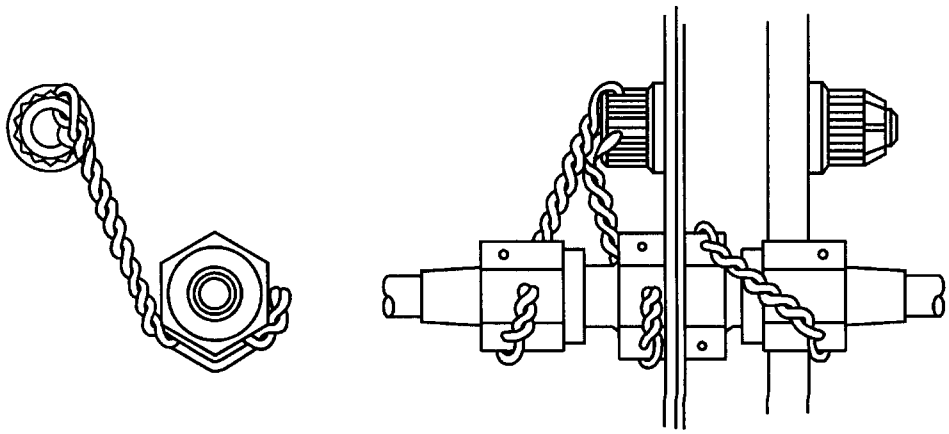
EXAMPLE 24



EXAMPLE 25



EXAMPLE 26

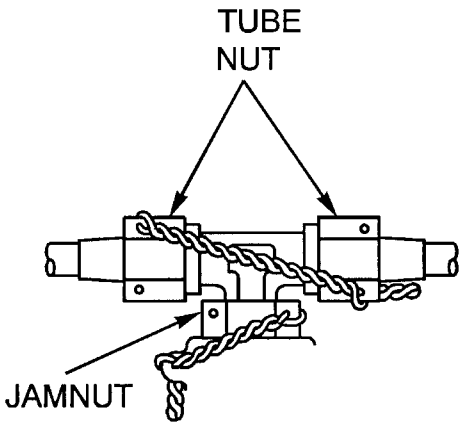


EXAMPLE 27
STRAIGHT CONNECTOR
(BULKHEAD-TYPE)

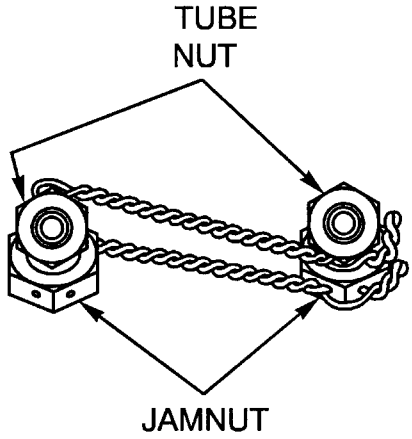
G-01001 (0802)
PW V

BM5 70 00 00 2 KGMP 00

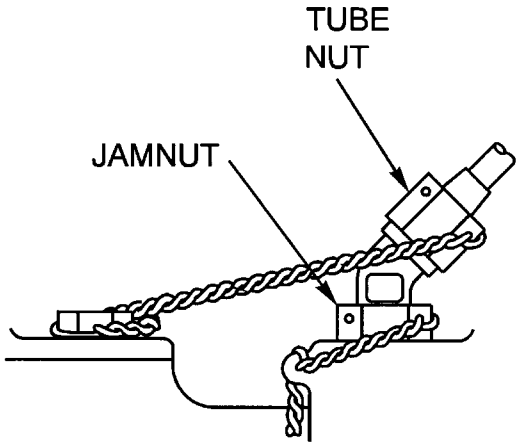
Installation of Safety Wire (Examples) (Sheet 4/5)
Figure 204



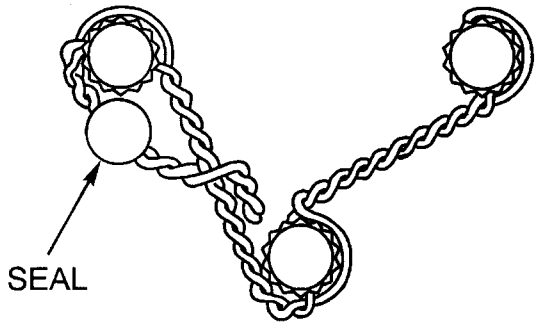
EXAMPLE 28



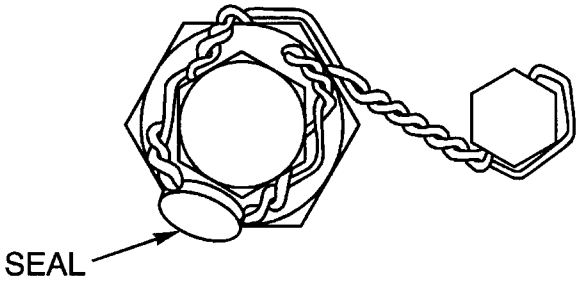
EXAMPLE 29



EXAMPLE 30



EXAMPLE 31



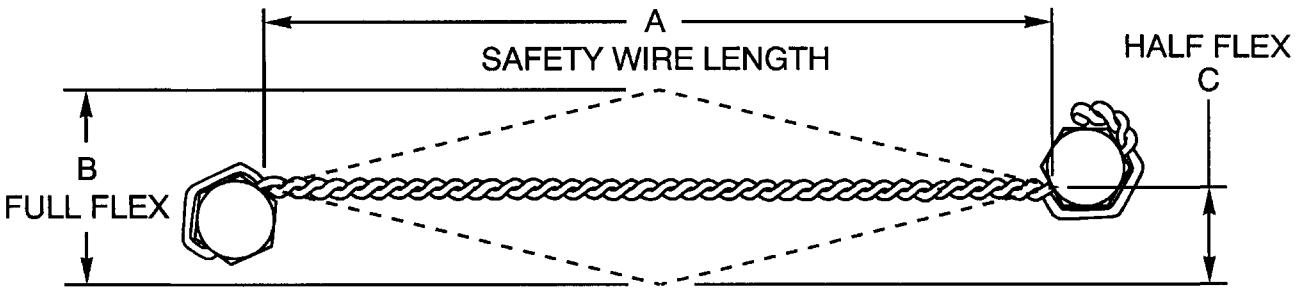
EXAMPLE 32

SEAL ATTACHED TO PROTECT IMPORTANT ADJUSTMENTS.

G-11776 (0802)
PW V

BM5 70 00 00 2 KGMU 00

Installation of Safety Wire (Examples) (Sheet 5/5)
Figure 204



INDEX A SAFETY WIRE LENGTH (SPAN)		INDEX B FULL FLEX LIMIT		INDEX C HALF FLEX LIMIT	
inch (mm)		inch (mm)		inch (mm)	
0.5	(12.700 mm)	0.125	(3.175 mm)	0.063	(1.600 mm)
1.0	(25.400 mm)	0.250	(6.350 mm)	0.125	(3.175 mm)
2.0	(50.800 mm)	0.375	(9.525 mm)	0.188	(4.775 mm)
3.0	(76.200 mm)	0.500	(12.700 mm)	0.250	(6.350 mm)
4.0	(101.600 mm)	0.500	(12.700 mm)	0.250	(6.350 mm)
5.0	(127.000 mm)	0.625	(15.875 mm)	0.313	(7.950 mm)
6.0	(152.400 mm)	0.625	(15.875 mm)	0.313	(7.950 mm)

BM5 70 00 00 2 KJM0 20

G-11779 (0802)
PW V

Installation of Safety Wire (Flex)
Figure 205

A. Reason for the Job

(1)This procedure gives instructions to install safety cable for the engine fasteners (includes bolts, screws, nuts and castle nuts), plugs, caps, fluid fittings, electrical connectors, pins and rod ends.

B. Equipment and Materials

ITEM	DESIGNATION
(1)	Bergen Mechanical Crimper (Alternative) - Model M303, M305 or M307
(2)Material No.P05-291	Special Materials (Ref. 70-00-00)
(3)Material No.P05-292	Special Materials (Ref. 70-00-00)

C. Procedure - General Specifications

(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks. The specific AMM maintenance task limits are for specific locations on the engine and for specific applications.

(2)Where safety cable is permitted in the specific AMM maintenance task, use the procedure which follows to install the cable.

(3)Generally you can use safety cable on the engine external parts. Do not use safety cable in the engine gaspath, on any external components, or on any fastener where the cable ferrule can go through the wire hole.

(4)You can replace safety cable with safety wire as necessary. Refer to the specific AMM maintenance task for the correct safety wire size for safety cable replacement.

(a)The correct safety wire and safety cable will be specified by part number in the specific AMM maintenance task.

(5)Obey the maximum safety cable length limits which follow.

(a)The maximum length (span) of safety cable between two tension points is 6 in. (152.4 mm) maximum, unless specified differently by the specific AMM maintenance task.

D. Procedure

(1)Torque the parts before you install the safety cable as follows (Ref. Fig. 206).

(a)All fasteners must be correctly torqued before you install the safety cable.

(b)For two or more fasteners safetied together, you must also put the wire holes in a correct position in relation to each other.

(c)To get the correct hole alignment, torque the fasteners to the limits for fasteners with wire holes. Refer to the specific AMM maintenance task or the Standard Torques (Ref. 70-00-00, P. Block 201).

(d)Do not decrease the torque less than the specified limit to correctly align the wire holes.

(e)Do not increase the torque more than the specified limit to correctly align the wire holes.

(f)If necessary, use another fastener or part to correctly align the wire holes within the specified torque limits.

(2)Get and examine the safety cable before installation as follows.

(a)Get new safety cable and its ferrule for each application. It is not

permitted to use the safety cable and ferrule again.
(b)Examine the safety cable for nicks, frayed strands, kinks or any damage.
(c)Damaged safety cable is not permitted, discard the damaged cable.
(3)Examine the safety holes as follows.
CAUTION : DO NOT USE SAFETY CABLE IF THE HOLES ARE MORE THAN 0.100 in. (2.54 mm) DIAMETER. IF YOU DO, THE FERRULES ON THE END OF THE CABLE WILL PULL THROUGH THE LARGER HOLES.
(a)Make sure that the safety holes on the parts are less than 0.100 in. (2.54 mm) diameter. The ferrules on the end of the cable are 0.106 to 0.108 in. (2.693 to 2.743 mm) diameter and will pull through the holes larger than this.
CAUTION : DO NOT INSTALL THE SAFETY CABLE IN HOLES WITH BURRS OR SHARP EDGES. IF YOU DO, THE SAFETY CABLE CAN BREAK DURING ENGINE OPERATION.
(b)Examine the safety holes for burrs or sharp edges.
(c)Remove the burrs or sharp edges from the safety holes.
(d)If necessary, replace the parts with burrs or sharp safety holes.
(4)Determine the direction and pattern of the safety cable for the parts that must be safetied (Ref. Fig. 206).
NOTE : The Figure given below (Sheets 1 and 2) does not show every possible combination of parts that can be safetied. Use these figures as a guide for other applications (Ref. Fig. 206).
(a)Install safety cable for a group of three bolts or screws as shown in Examples 1 and 2.
(b)Install safety cable for a group of two bolts or nuts as shown in Examples 3.
1 The safety holes can be aligned in a straight direction for the installation of safety cable.
2 Use groups of the two bolt pattern when you apply safety cable to an even number of fasteners.
(c)Install safety cable for two hollow head plugs as shown in Example 4.
(d)Install safety cable for tube and hose nuts as shown in Example 5.
(e)Install safety cable for tube nuts on a tee as shown in Example 6.
(f)Install safety cable for a coupling as shown in Example 7.
(g)Install safety cable for a tube tee with safety cable holes as shown in Example 8.
(h)Install safety cable for a filter cover as shown in Example 9.
(j)Install safety cable for a single hollow head plug to a lug with a safety cable hole as shown in Example 10.
(k)Install safety cable for a knurled nut as shown in Example 11.
(l)Install safety cable for rod ends with jam nuts as shown in Examples 12 and 13.
(5)Install the safety cable as follows.
(a)Always install safety cable through the safety cable or safety wire holes given on the part.
(b)Do not install the safety cable down through the bolt lightening holes (Ref. Fig. 206) (Sheet 2/2) Example 14.
(c)Install the safety cable so that it always applies tension to tighten the parts or a neutral pull.
(d)Safety cable is not a means to get or keep torque, but a safety device

used to prevent disengagement of the part.

(e)The maximum length (span) of safety cable between two tension points is 6 in. (152.4 mm) maximum, unless specified differently by the specific AMM maintenance task.

(f)Do not install the safety cable through the fasteners with sharp turns more than 90 degrees. This will produce installed safety cable with either a positive or neutral pull. The better condition is to have the cable clearly positive. Where this is not possible because of interference across an edge of a gusset, bracket or other part, the use of a neutral condition is acceptable.

(g)Crimp the ferrule to the cable with the Bergen Mechanical Crimper (Model M303, M305 or M307).

1 The safety cable must meet the minimum crimp requirements of Table 201.

Nominal Cable Diameter	Minimum Pull-Off Load
0.020 in. (0.508 mm)	30 lbf.in. (0.339 m.daN)
0.032 in. (0.813 mm)	70 lbf.in. (0.791 m.daN)
0.040 in. (1.016 mm)	130 lbf.in. (1.469 m.daN)

NOTE : The pull-off load is the force necessary to pull the cable out of either the ferrule or the cable end fitting.

Safety Cable Minimum Crimp Requirements (Pull-Off Load)
Table 201

(h)Crimp a lead seal to the safety cable when specified by the specific AMM maintenance task.

(6)Trim off the unwanted safety cable as follows.

CAUTION : BE SURE THAT THE CUT CABLE ENDS DO NOT FALL INTO THE ENGINE. IF THEY DO, THE SAFETY CABLE CAN CAUSE DAMAGE DURING ENGINE OPERATION.

(a)The Bergen Mechanical Crimper (Model M303, M305 or M307) cuts the cable to the correct length when you crimp the ferrule.

(b)Cut off excess cable from the crimped ferrule with wire cutter pliers.

(c)Make sure that the maximum length of unwanted cable past the crimped ferrule is 0.031 in. (0.787 mm).

(7)Examine the safety cable after installation as follows.

(a)Examine the safety cable for damage as follows.

1 Examine the safety cable for nicks, frayed strands, kinks or any damage.

2 Damaged safety cable is not permitted.

3 Remove and replace the damaged safety cable.

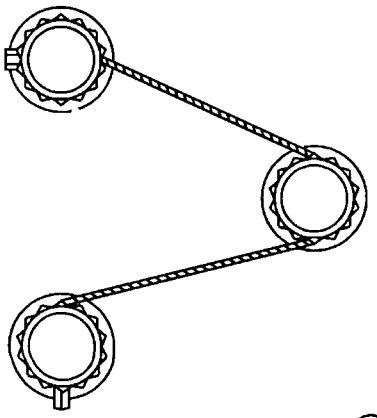
(b)Examine the safety cable for flex limits as follows.

1 Push on the safety cable at mid-span with light finger pressure, approximately 2 lbs (0.91 kg).

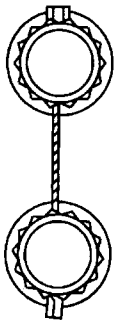
2 The total flex for the safety cable must not be more than the limits shown in the Figure (Ref. Fig. 207).

R 8. Installation of Cotter Pins

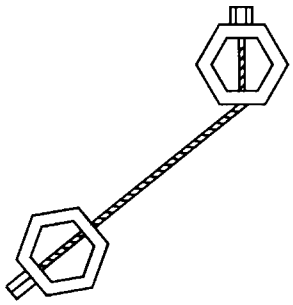
EXAMPLE 1
BOLTS



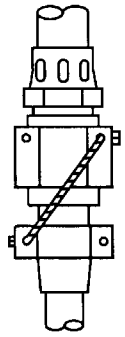
EXAMPLE 2
BOLTS



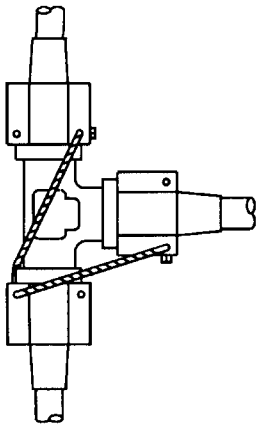
EXAMPLE 3
BOLTS



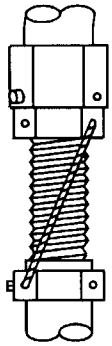
EXAMPLE 4
PLUGS



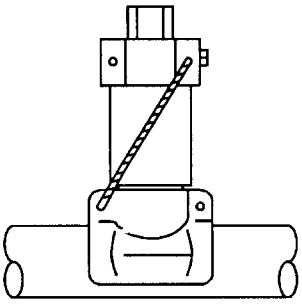
EXAMPLE 5
HOSE AND TUBE NUTS



EXAMPLE 6
TUBE TEE



EXAMPLE 7
COUPLINGS

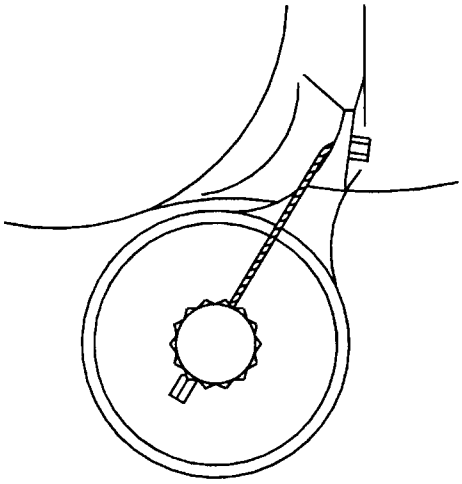


EXAMPLE 8
TUBE TEE

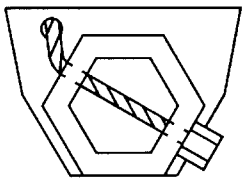
BM5 70 00 00 2 KLMA 00

G-01002 (0802)
PW V

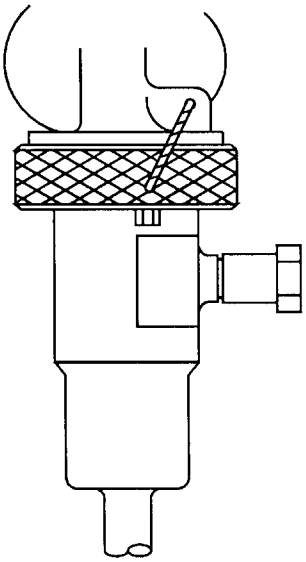
Installation of Safety Cable (Examples) (Sheet 1/2)
Figure 206



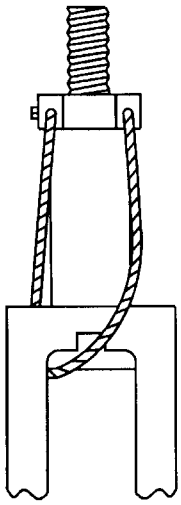
EXAMPLE 9
FILTER COVER



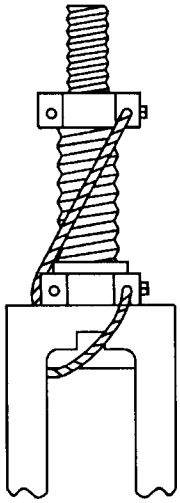
EXAMPLE 10
PLUG



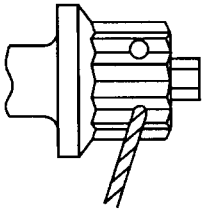
EXAMPLE 11
KNURLED NUT

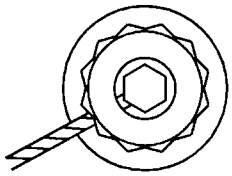


EXAMPLE 12
ROD END



EXAMPLE 13
ROD END



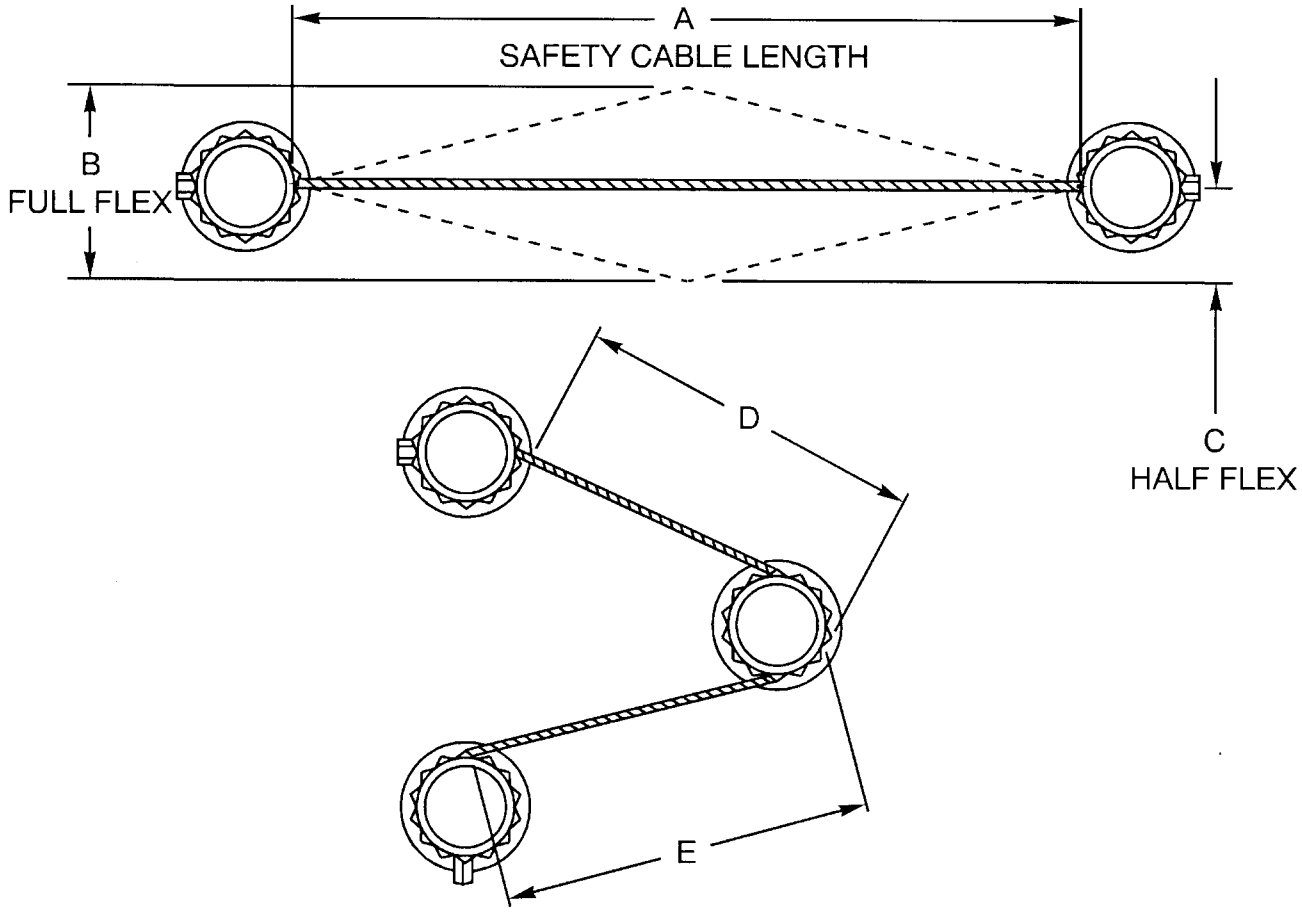


EXAMPLE 14
UNSATISFACTORY INSTALLATION

BM5 70 00 00 2 KLMM 01

G-01003 (0802)
PW V

Installation of Safety Cable (Examples) (Sheet 2/2)
Figure 206



FOR THREE BOLT PATTERNS
A = D + E

INDEX A SAFETY WIRE LENGTH (SPAN)		INDEX B FULL FLEX LIMIT		INDEX C HALF FLEX LIMIT	
inch (mm)		inch (mm)		inch (mm)	
0.5	(12.700 mm)	0.125	(3.175 mm)	0.063	(1.600 mm)
1.0	(25.400 mm)	0.250	(6.350 mm)	0.125	(3.175 mm)
2.0	(50.800 mm)	0.375	(9.525 mm)	0.188	(4.775 mm)
3.0	(76.200 mm)	0.375	(9.525 mm)	0.188	(4.775 mm)
4.0	(101.600 mm)	0.500	(12.700 mm)	0.250	(6.350 mm)
5.0	(127.000 mm)	0.500	(12.700 mm)	0.250	(6.350 mm)
6.0	(152.400 mm)	0.625	(15.875 mm)	0.313	(7.950 mm)

BM5 70 00 00 2 KNM0 20

G-01004 (0802)
PW V

Installation of Safety Cable (Flex)
Figure 207

A. Equipment and Materials

ITEM	DESIGNATION
(1)None	

B. Procedure - General Instructions

(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
(2)Use cotter pins only one time. Use a new cotter pin for each installation.
(3)Use the correct cotter pin as specified by the AMM maintenance task.

C. Procedure

(1)Install a cotter pin to safety a nut as follows (Ref. Fig. 208).
(a)Torque the fastener to the minimum torque limit as specified by the AMM task.
(b)If the cotter pin hole does not align with the slot, continue to torque the fastener to the maximum torque as specified by the AMM task but only enough for alignment.
(c)If you cannot get the alignment with the fastener torqued within the specified limits, replace the fastener with a different one.
(d)Continue to torque the fastener to the torque specified by the AMM task for alignment.
(e)Make sure more than 50 percent of the pin hole is below the top edge of the nut (Ref. Fig. 208) (See view A).
(f)Install the cotter pin as follows.
1 Install and align the cotter pin so that you can bend the prongs up and over the bolt and down over the nut.
2 While you hold the head tight to the hole, bend the prongs so that the upper prong is tight on the end of the bolt and the bottom prong is tight on the side of the nut.
a Do not bend the cotter pin head.
3 If necessary, cut off the end of the upper prong to be level with the end of the bolt.
4 If necessary, cut off the end of the lower prong for a tight fit on the nut.
(2)Install a cotter pin to safety a pin, rod or collar as follows (Ref. Fig. 208).
(a)Install the cotter pin as follows.
1 Install and align the cotter pin so that you can bend the prongs around the outside diameter of the pin, rod or collar.
2 While you hold the head tight to the hole, bend the prongs against the outside diameter of the pin, rod or collar.
a Do not bend the cotter pin head.
3 If necessary, cut off the end of the prongs to get the correct length.
(3)Examine the installed cotter pin as follows.
(a)Make sure that a new cotter pin was installed.
(b)Make sure that the prongs are bent as previously specified.
(c)Make sure that the prongs are bent so that the cotter pin and fastener

cannot move or turn to loosen.

(d)Scoring, gouging and smearing of the cotter pin or adjacent parts are not permitted.

(e)Small tool marks from usual forming and bending procedures are permitted.

R 9. Installation of Retaining Rings

A. Equipment and Materials

ITEM	DESIGNATION
(1)None	

B. Procedure - General Instructions

(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2)Retaining rings must be installed with approved retaining ring pliers.

(a)Internal-type rings must not be compressed beyond the point where the ends of the rings meet.

(b)External-type rings must be expanded only enough to permit installation without becoming bent.

(3)After installation, make sure each retaining ring is fully seated, without looseness or distortion, in its groove.

(4)Distorted retaining rings must be replaced.

C. Procedure - Plain Retaining Rings

(1)Plain retaining rings can contain slightly rounded edges on one side and sharp edges on the opposite side. The slight rounding, caused by the stamping die, is not a bevel and the ring must not be classified a beveled ring.

(2)Plain retaining rings must be installed only in square sided grooves. When one side of a plain ring has visibly sharper corners, this side must be installed away from the detail part being retained, so that the sharp-edged side thrusts against the groove.

D. Procedure - Beveled Retaining Rings

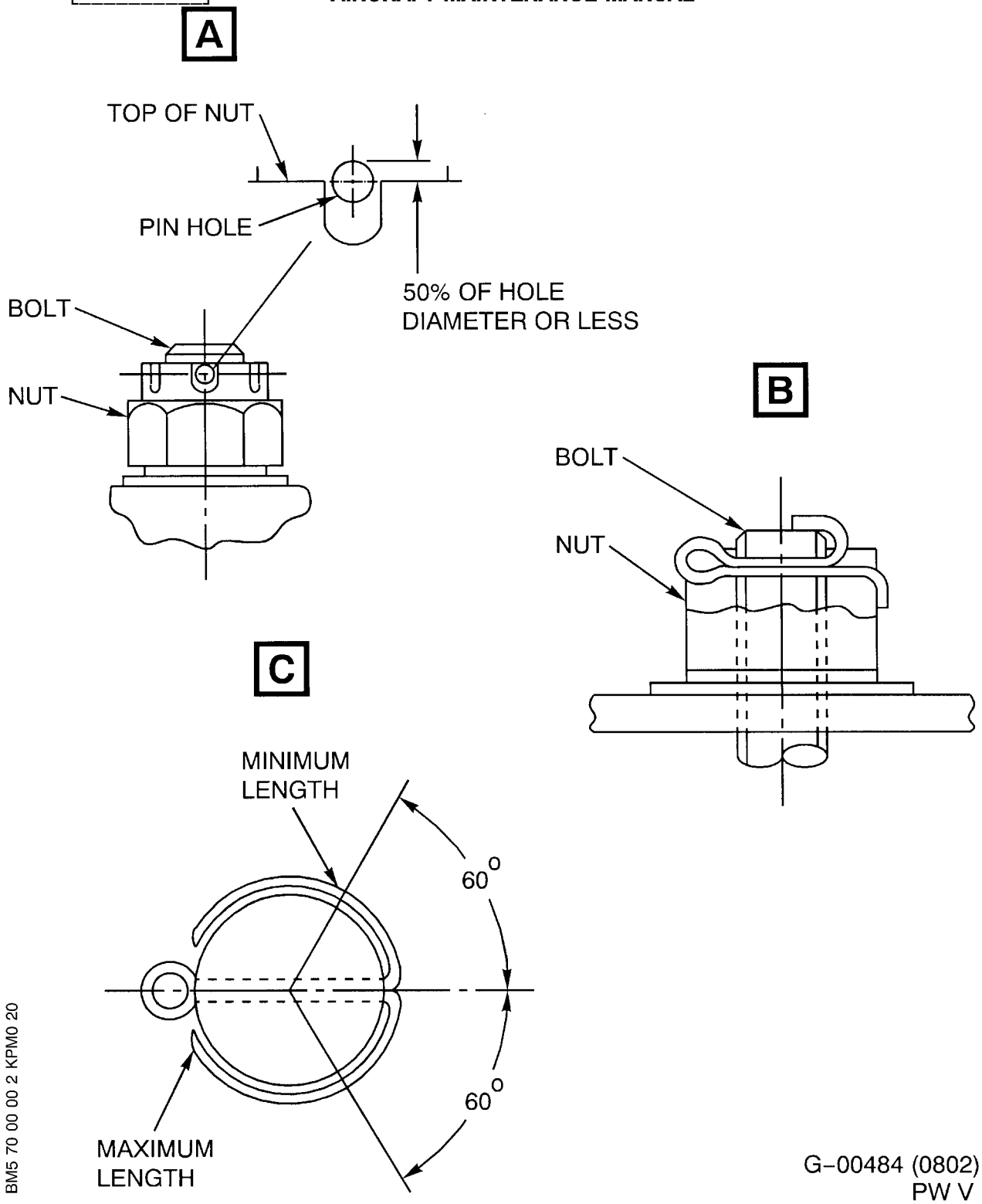
(1)Beveled retaining rings have the added function of taking up end play in the detail part being retained. This type ring has a definite 15 degree bevel on one side designed to fit a corresponding bevel on the side of the groove away from the part being retained.

(2)Beveled retaining rings should be used only in corresponding beveled grooves. These rings should be installed with the flat side of the ring toward the detail part being retained (Ref. Fig. 209).

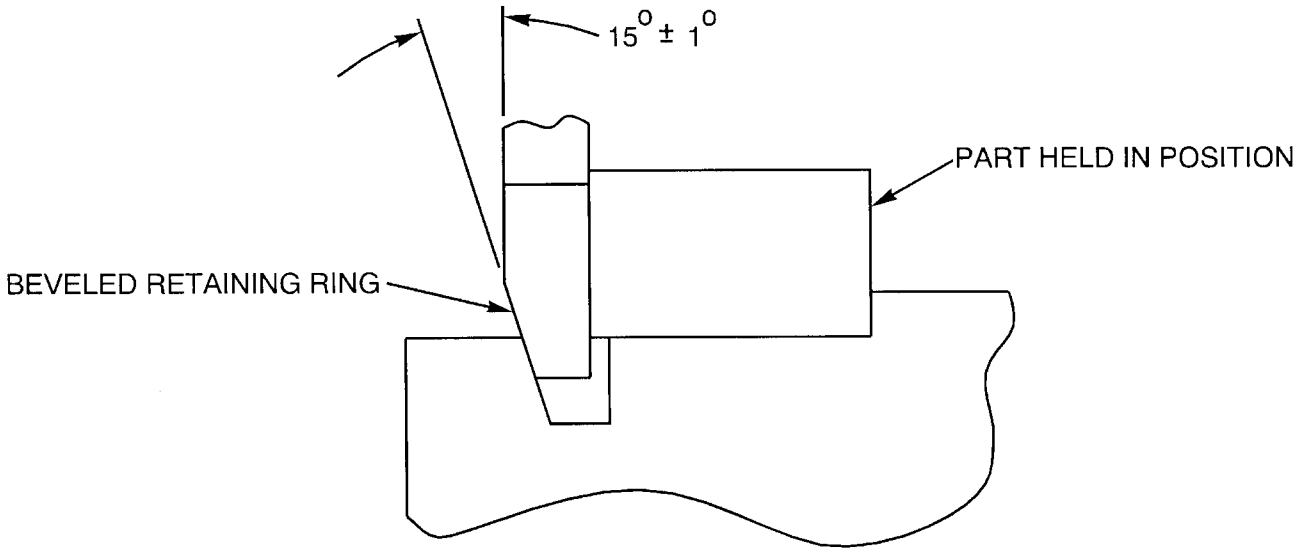
R 10.Replacement of Damaged Tube Nuts and Thrust Wire

A. Reason for the Job

(1)This procedure gives the necessary instructions to replace a damaged tube nut or thrust wire on an external tube when the tube nut is retained by a thrust wire. This procedure can also be used to repair a tube which



Installation of Cotter Pins
Figure 208



BM5 70 00 00 2 KRM0 20

G-00481 (0802)
PW V

Installation of Retaining Rings
Figure 209

is attached inside the engine cases and cannot be removed. Repair of a tube attached inside the engine should only be done by an experienced operator following the additional steps given below.

B. Equipment and Materials

ITEM	DESIGNATION
(1)	Caps
(2)	Plugs
(3)	Bantam Bully Air Hammer Available from : Superior Pneumatic and Manufacturing Inc. 855 Canterbury Rd. Westlake, OH 44145, USA
(4)PWA 21411	Anvil
(5)Material No.P03-001	Oils (Ref. 70-00-00)

C. Procedure - General Instructions for Tubes Attached Inside the Engine Cases

(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.

CAUTION : THE SUBSEQUENT STEPS SHOULD ONLY BE DONE BY AN EXPERIENCED OPERATOR. IF YOU DAMAGE A TUBE WHICH IS ATTACHED INSIDE THE ENGINE CASES, IT WILL BE NECESSARY TO REMOVE THE ENGINE FOR TUBE REPLACEMENT.

CAUTION : INSTALL PROTECTION COVERS OVER ALL OPENINGS AS SOON AS POSSIBLE TO PREVENT ENGINE DAMAGE.

(2)Disconnect the mating tube from the damaged tube nut.

(3)Cover all openings to protect them from entry by foreign objects.

(4)Put a temporary plug in the tube ferrule or fitting to keep machining chips and dirt out of the tube.

(5)If you damage a tube which is captured in the engine cases, it will be necessary to remove the engine for tube replacement.

(6)Follow the instructions in the subsequent paragraph for the removal of the thrust wire.

CAUTION : WHEN YOU INSTALL THE NEW THRUST WIRE INTO THE NEW TUBE NUT, YOU MUST SUPPORT THE TUBE NUT WITH AN OPPOSITE FORCE SO AS NOT TO DEFORM THE TUBE.

(7)When you install the new thrust wire into the new tube nut, you must support the tube nut with an opposite force.

D. Removal of the Damaged Tube Nut and Thrust Wire (Ref. Fig. 210, 211)

CAUTION : THE INSTRUCTIONS IN THIS PARAGRAPH APPLY TO DAMAGED TUBES WHICH HAVE BEEN REMOVED FROM THE ENGINE. IF THE TUBE BEING REPAIRED IS ATTACHED INSIDE THE ENGINE CASES, YOU MUST OBEY THE PRECAUTIONS IN THE PREVIOUS PARAGRAPH.

(1)If possible, remove the damaged tube from the engine.

(2)Put a temporary plug in the tube ferrule or fitting to keep machining chips and dirt out of the tube.

(3)To remove the thrust wire from the nut, hold the drilled end and pull the wire out of the nut.

NOTE : For tubes with plain thrust wire, you can pull either end of the

thrust wire out of the nut.

(4)Discard the thrust wire.

(5)If the thrust wire is damaged or too tight, it will be necessary to cut the nut off of the tube end as follows.

(a)Support the tube nut on a hard work surface or in a soft-jawed vise.

CAUTION : BE CAREFUL WITH THE CUT-OFF WHEEL NOT TO DAMAGE THE FERRULE OR FITTING ON THE TUBE.

(b)Use a high speed cut-off wheel to cut around the nut small distance outboard of the thrust wire, until the wire area is open.

(c)Remove the thrust wire and nut from the tube.

(d)Discard the thrust wire.

(6)Examine the tube end for any damage.

E. Installation of the New Tube Nut and the New Thrust Wire (Ref. Fig. 210, 211).

(1)Always use a new thrust wire for each installation.

(2)Put the new nut in position on the end of the tube ferrule or fitting.

(3)Apply a small amount of Engine Oil (Material No.P03-001) to the new thrust wire.

(4)While you install the new thrust wire, hold the tube nut as follows.

(a)For tubes removed from the engine, support the new tube nut on a bench or in a soft-jawed vise.

(b)For tubes captured inside the engine cases, support the tube nut with an opposite force.

CAUTION : BEFORE YOU PUSH THE THRUST WIRE INTO POSITION, MAKE SURE THAT THE THRUST WIRE IS ALIGNED WITH THE REAR RADIUS OF THE TUBE FERRULE OR FITTING. USE A STRONG LIGHT OR A SMALL TEST WIRE TO BE SURE THAT THE WIRE HOLE IN THE NUT WILL LET THE THRUST WIRE GO AGAINST (BUT NOT INTO) THE RADIUS ON THE FERRULE OR FITTING.

(5)With the new tube nut in position on the end of the tube, put the new thrust wire into position.

(6)If the thrust wire goes into the hole easily, tap the thrust wire into position with a brass (or other non-ferrous) mallet.

CAUTION : WHEN YOU USE AN AIR HAMMER, BE SURE NOT TO BEND THE THRUST WIRE OR PUSH THE THRUST WIRE AGAINST THE TUBE FERRULE OR FITTING.

(7)If you cannot easily push the thrust wire into the hole, examine the alignment again.

(8)If the alignment is good, use a Bantam Bully Air Hammer and a PWA 21411 Anvil to push the thrust wire into position.

(9)Make sure that the thrust wire comes out of the other side of the nut and is fully installed.

(10)Make sure the nut is held on the tube and the nut is able to turn smoothly.

(11)Remove the plug from the tube.

(12)Examine the tube end for any damage or blockage.

(13)If applicable, safety the thrust wire with safety wire. Refer to the Installation of Safety Wire (Ref. 70-00-00, P. Block 201) or the Installation of Safety Cable (Ref. 70-00-00, P. Block 201) and the specific AMM maintenance task for safety procedures.

(14)Install or connect any tubes as necessary.

R 11.Tightening Torques

A. Equipment and Materials

ITEM	DESIGNATION
(1)None	

B. Procedure - General Torque Instructions

(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2)Torque values to be used for J threads are identical to torques applied to standard threads.

(3)Torque limits listed in this section shall be interpreted as follows.

(a)Torque values in pound-inches (Deca Newton meters) - lbf.in. (m.daN).

(b)Angles of turn in degrees.

(c)Stretch values in inches (mm).

(4)If part to be tightened is hot, allow sufficient time to elapse to allow temperature of part to reach a temperature equilibrium with surrounding area before final torquing.

(5)Use caution when you join of flanges or mating sections during assembly. When you join snap fits, it is essential that mating parts be correctly seated prior to application of final torque. Unless specific procedures are provided in assembly instructions, parts should be seated by installing several bolts at regular intervals then applying uniform torque where required to seat the mating surfaces. Once seating is assured, all bolts should be torqued to approximately 75 percent of final torque in a uniform stagger (180, 90 and 45 degree intervals, etc.) to prevent local overstressing of the bolts or flange. Final torque should be applied in same sequence.

(6)Torque applications should be done slowly and evenly for consistency and best possible accuracy. There may be instances, other than specific torque limits, where it is obvious that standard torque required should not be used due to the material or design of the engine part. Use common sense and good judgment in such cases.

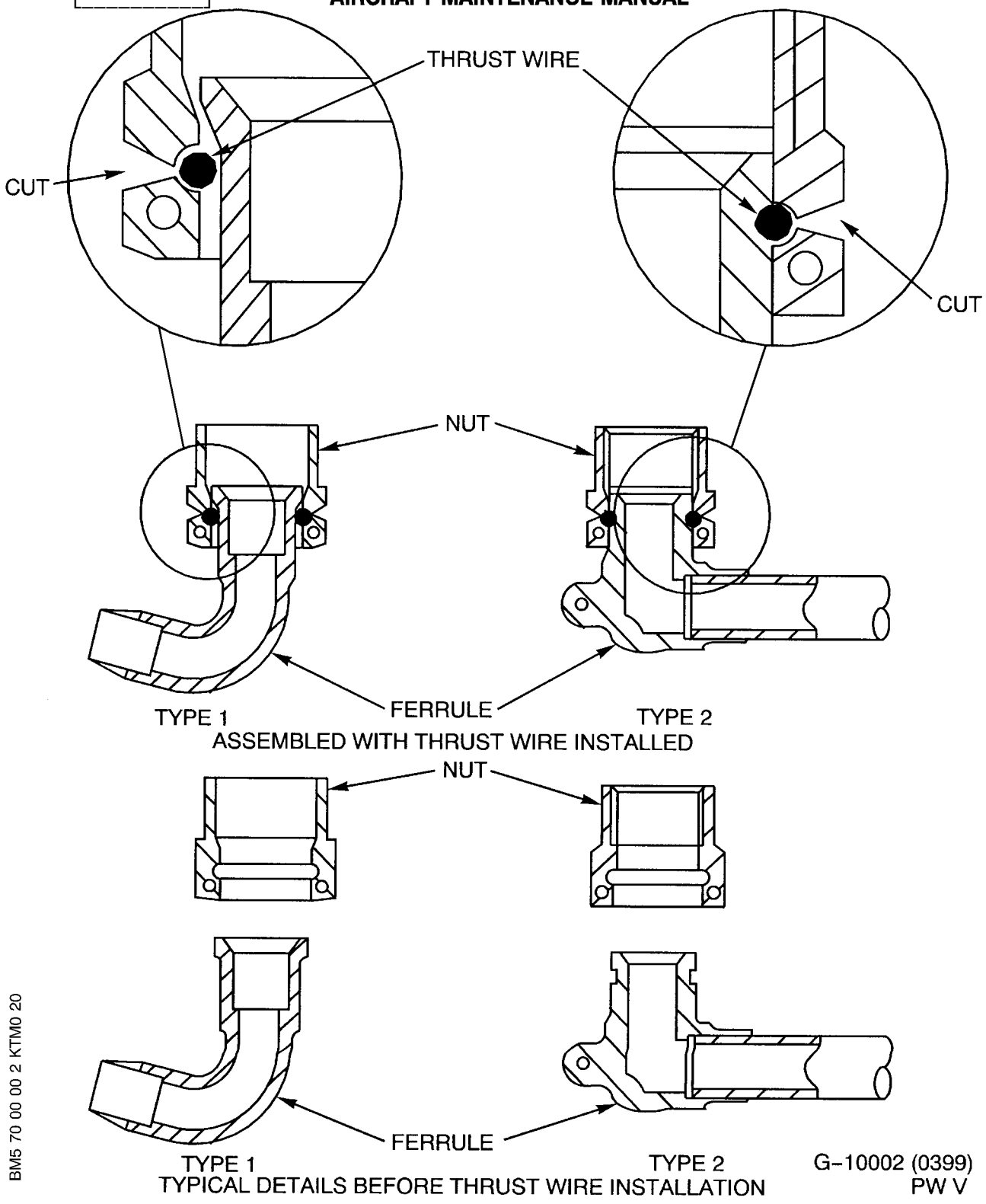
(7)Refer to Torque Indication Devices (Torque Wrenches) (Ref. 70-00-00, P. Block 201) for the correct size and use of torque wrenches and torque adapters.

(8)Refer to Standard Torques (Ref. 70-00-00, P. Block 201) for standard torque recommendations.

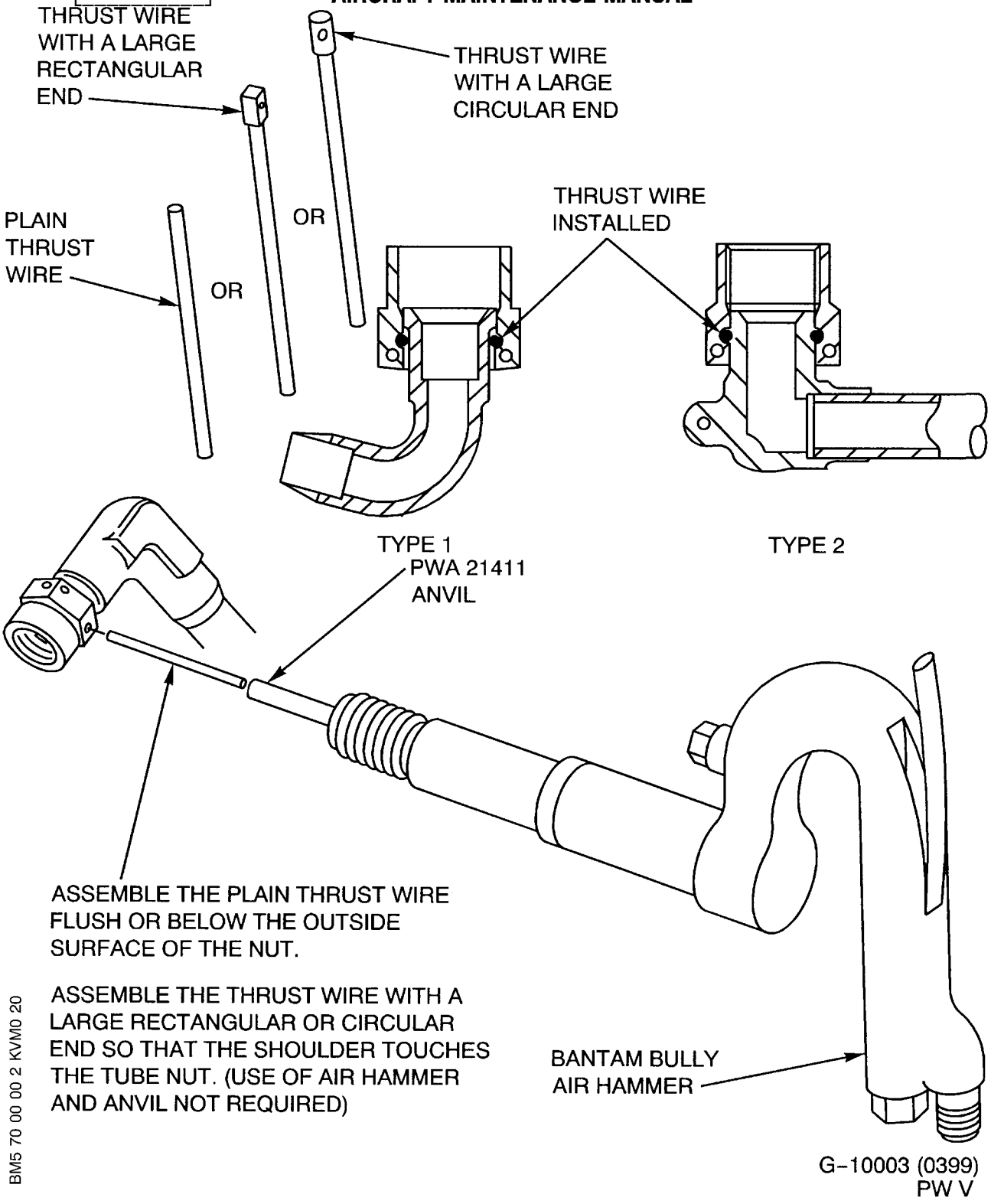
R 12.Torque Indication Devices (Torque Wrenches)

A. Equipment and Materials

ITEM	DESIGNATION
(1)	Torque Wrench



Replacement of Damaged Tube Nuts and Thrust Wire
Figure 210


THRUST WIRE WITH A LARGE RECTANGULAR END
THRUST WIRE WITH A LARGE CIRCULAR END
PLAIN THRUST WIRE
OR
OR
THRUST WIRE INSTALLED
TYPE 1
TYPE 2
PWA 21411 ANVIL
ASSEMBLE THE PLAIN THRUST WIRE FLUSH OR BELOW THE OUTSIDE SURFACE OF THE NUT.
ASSEMBLE THE THRUST WIRE WITH A LARGE RECTANGULAR OR CIRCULAR END SO THAT THE SHOULDER TOUCHES THE TUBE NUT. (USE OF AIR HAMMER AND ANVIL NOT REQUIRED)
BANTAM BULLY AIR HAMMER
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Replacement of Damaged Tube Nuts and Thrust Wire
Figure 211

B. Procedure - Torque Indication Devices

NOTE : Torque indicating devices are referred to as torque wrenches.

(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2)Make sure that the torque wrench is calibrated.

(3)Calibrate all torque wrenches as follows.

(a)Inspect and calibrate all torque indicating devices by the schedule which follows.

1 Manual Non-Set Type Torque Wrenches (Beam Type)
- 39 weeks

2 Manual Set Type Torque Wrenches (Click Type)
- 39 weeks

3 Hydraulic Wrenches
- 39 weeks

(b)Do all torque wrench calibrations with a calibrated weight and measured lever arm device to make sure of an accurate calibration.

(c)Do not compare one torque wrench to another torque wrench for accurate calibration.

(d)Always hold and use a torque wrench as specified in the manufacturer's instructions for accurate torque indications.

(4)Use the correct size torque wrench as follows.

(a)Select the correct size torque wrench so that the specified torque is between 25 percent and 95 percent of the torque wrench maximum indication.

(b)Use the torque wrench that will have the best and most accurate indication graduations.

(5)Use a torque wrench and extension (torque adapter) as follows (Ref. Fig. 212).

NOTE : Torque extensions are referred to as torque adapters.

(a)There are many situations which require you to use a torque adapter. When you use a torque adapter you must calculate the torque wrench indication so that you apply the specified torque to the fastener.

(b)When you install a torque adapter to a torque wrench you can change the effective beam length of the torque wrench. You can install the torque adapter in three ways. When you change the effective beam length, you must calculate the torque wrench indication so that you apply the specified torque to the fastener.

1 For the installation of a torque adapter which increases the effective beam length, calculate the indicated torque value using Method A (Ref. Fig. 213) (Sheet 1/2).

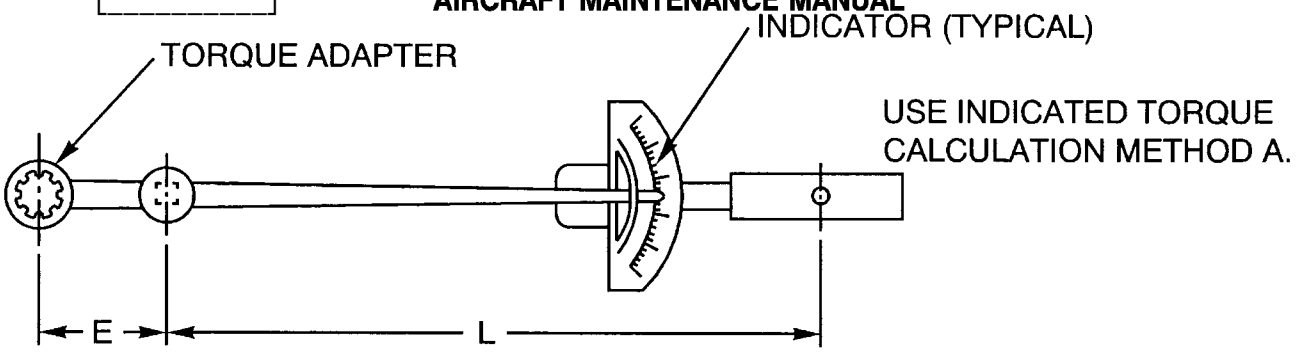
2 For the installation of a torque adapter which decreases the effective beam length, calculate the indicated torque value using Method B (Ref. Fig. 213) (Sheet 2/2).

3 For the installation of a torque adapter which does not effect beam length, no calculation is necessary.

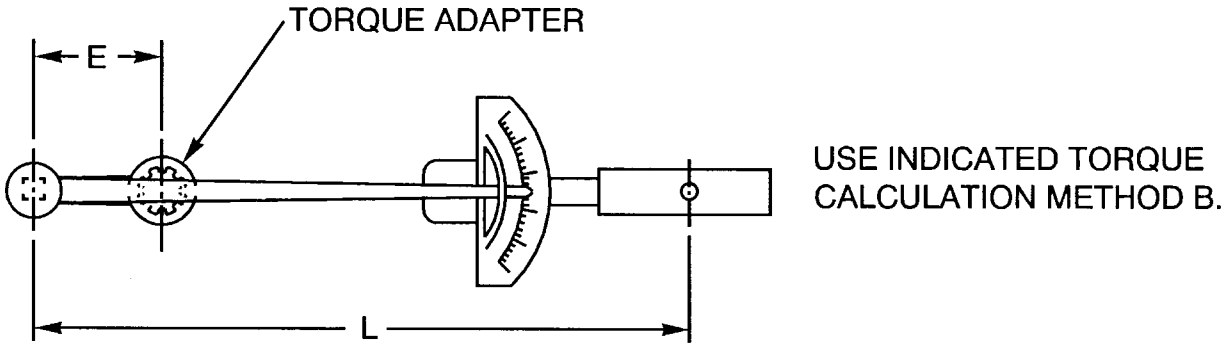
(6)Refer to Standard Torques (Ref. 70-00-00, P. Block 201) for standard torque recommendations.

R 13.Standard Torques

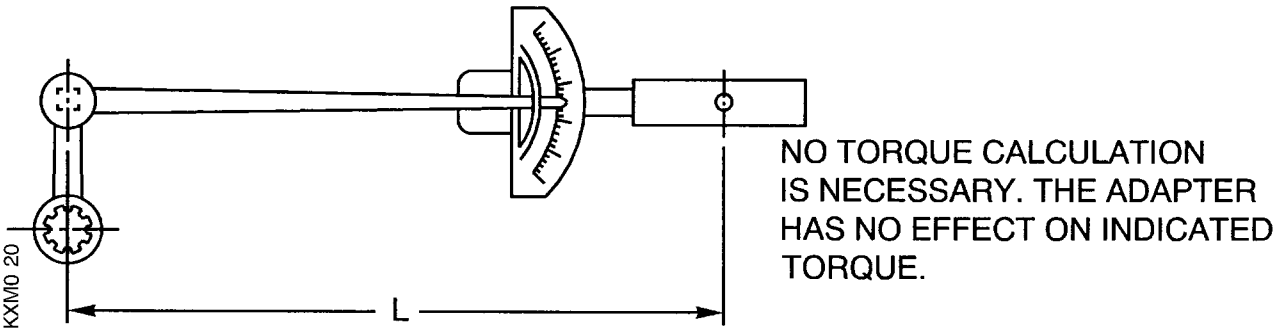
A. Equipment and Materials



INCREASED EFFECTIVE BEAM LENGTH



DECREASED EFFECTIVE BEAM LENGTH



UNCHANGED BEAM LENGTH

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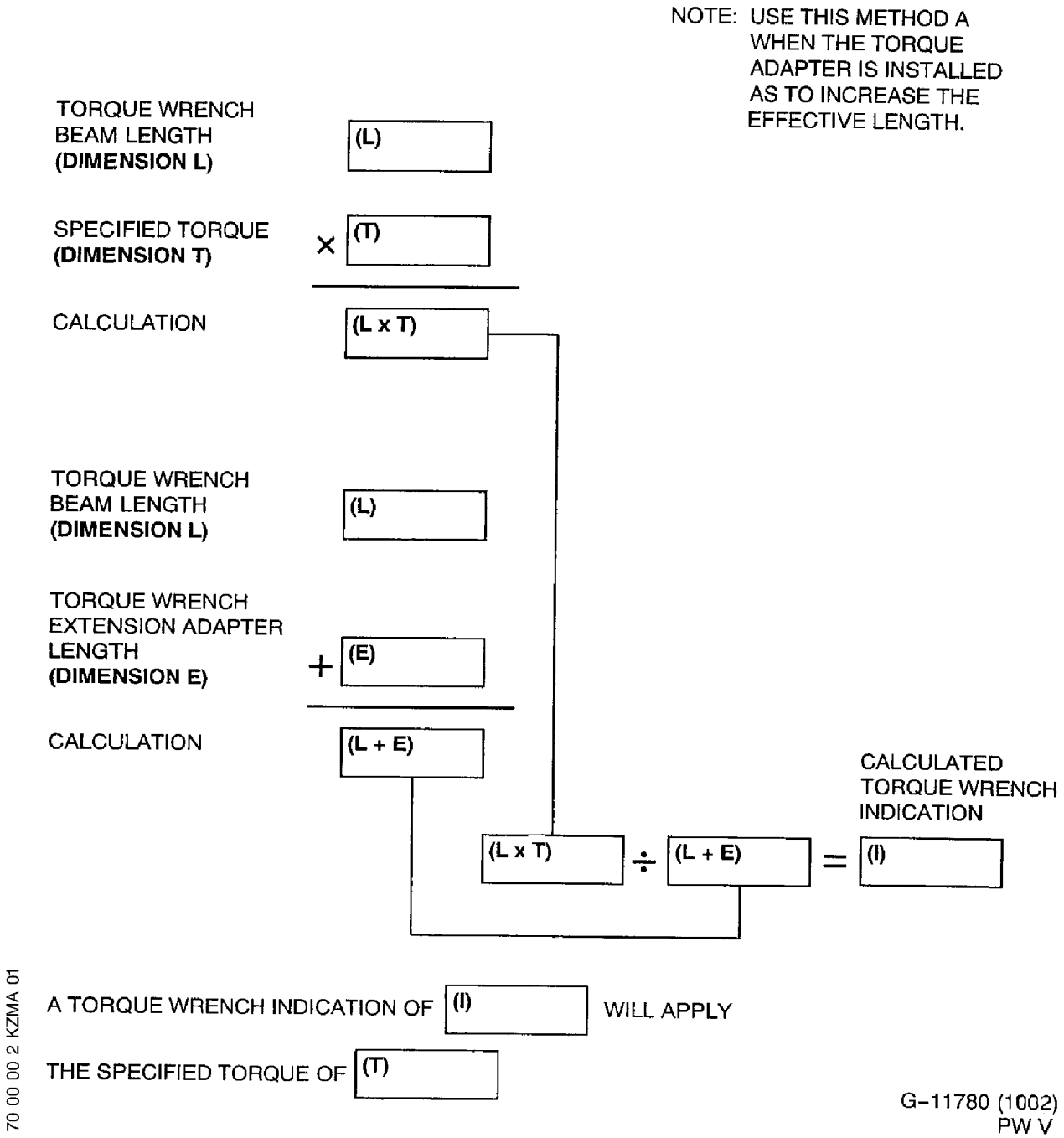
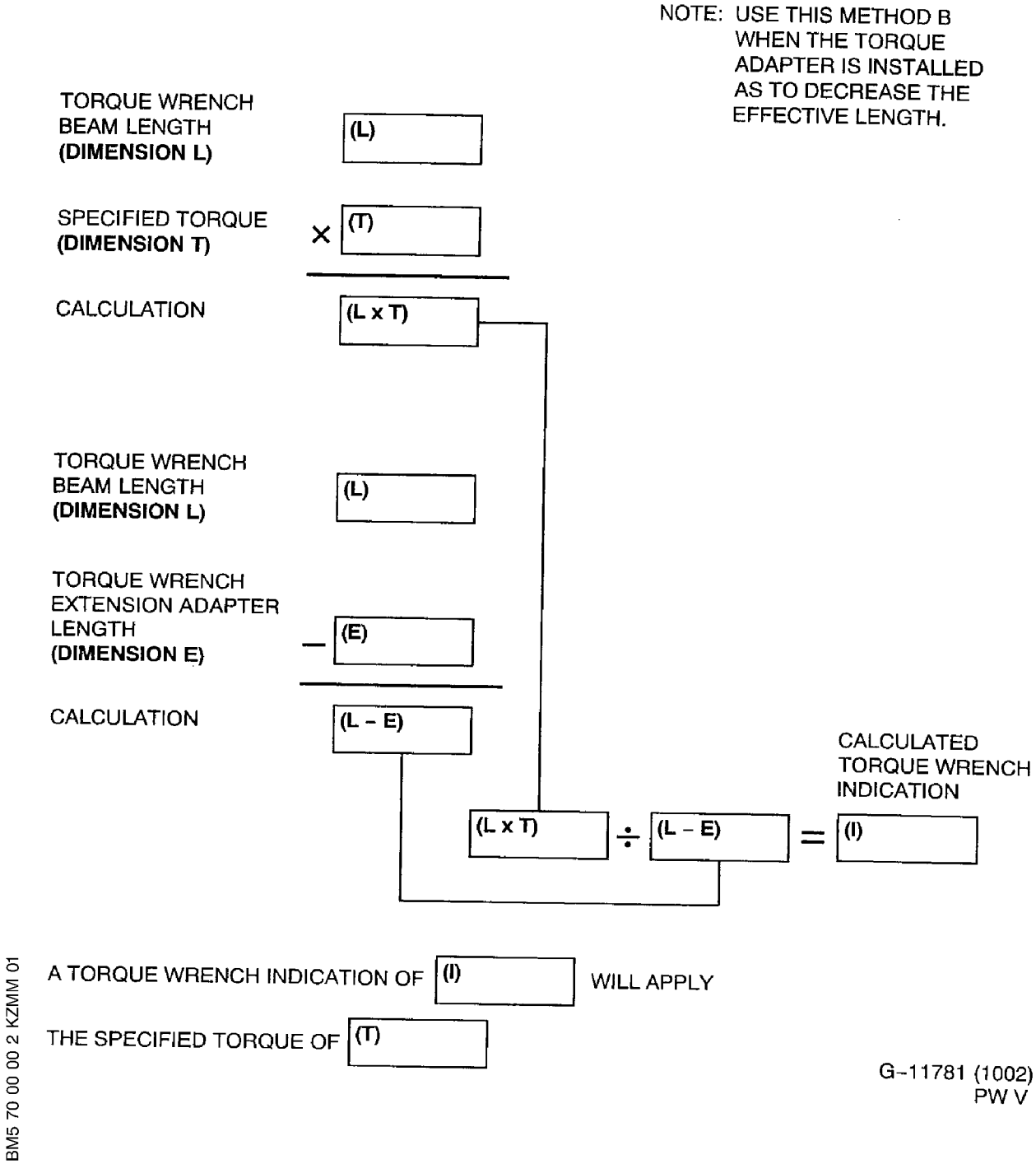
Torque Indication Devices (Torque Adapter Configurations)
Figure 212



BM5 70 00 00 2 KZMA 01

Torque Indication Devices (Torque Calculation - Method A)
(Sheet 1/2)
Figure 213



BM5 70 00 00 2 KZMM 01

Torque Indication Devices (Torque Calculation - Method B)
(Sheet 2/2)
Figure 213

ITEM	DESIGNATION
(1)	Torque Wrench (as specified by the specific AMM maintenance task)
(2)	Oil or Lubricant (as specified by the specific AMM maintenance task)
(3)Material No.P03-001	Oils (Ref. 70-00-00)

B. Procedure - General Torque Instructions
(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks. If these standard torque values do not agree with specified torque values in a specific AMM task, use the specified limits in the specific AMM task and not these standard values.
(2)It is recommended that the nut be turned rather than the bolt wherever possible.
(3)If you turn the bolt, do as follows to get the correct tension and to prevent any scoring of a bolt, bolthole or bearing surface.
(a)The bolt (this includes close tolerance shank bolts) must pass freely through aligned holes.
(b)Where the flange material is soft (for example, aluminum and magnesium), an Engineering-specified washer must be present under the bolt head.
(c)The bolt head bearing surface must be lubricated.

C. Lubricants and Lubrication
(1)Unless specified differently, torque values listed in this section apply when lubrication is applied to at least one of each pair of surfaces that will experience rubbing contact during the torquing process. Engine Oil (Material No.P03-001) lubrication must be used unless antigalling/ antiseize compound is used.
(2)Unless specified differently, the application of both oil and antigallant on the same pair of surfaces is not permitted. Apply the correct lubricant as specified in the specific AMM maintenance task.
(3)Torque for oil lubricated parts (except studs)
(a)Torque limits for oil lubricated parts apply specifically to the use of Engine Oil (Material No.P03-001) on the parts.
(4)Torque for antigallant lubricated parts
(a)Torque limits for antigallant lubricated parts apply specifically to the use of compounds listed in the specific AMM maintenance task.

D. Free-Spinning Fasteners (Ref. Fig. 214)
(1)General
(a)Torque values specified in Figure (Ref. Fig. 214) for nuts, bolts, and screws have been established to provide sufficient preload without overstressing the parts and are based on materials having minimum ultimate tensile strengths of 125,000 psi (861,844.6 kPa), equivalent to a hardness of 26HRC for steel parts.
(b)The torque values specified in Figure (Ref. Fig. 214) apply to bolts in standard helical coil inserts as long as full thread engagement of the insert is accomplished.

(2)Thin nuts, slotted nuts
(a)The torque values specified in Figure (Ref. Fig. 214) shall apply to nuts where the height of the nut is greater than 75 percent of the major diameter of the thread.
(b)For thin nuts, where the height of the nut is 40 to 75 percent of the size of the major diameter, reduce the torque values 50 percent.
(c)For slotted nuts, the height shall be taken as the distance from the washer face to the bottom of the slots.
(d)Values do not apply to hollow bolts and screws.
(3)Lockwire and cotter pin requirements
(a)After you tighten and correctly torque a castle nut, screw or bolt, do not loosen to get the necessary alignment of cotter pin holes or wire holes.
(b)If the holes or slots are not correctly aligned at the minimum torque limit, tighten the fastener more until there is correct alignment. Do not exceed the maximum torque limit.
(c)If you cannot get the correct alignment, loosen the fastener one half a turn, then retorque.
(d)If you cannot get the correct alignment, replace the fastener with a different one.

E. Self-Locking Nuts (Ref. Fig. 215)
NOTE : Refer to Reuse of Self-Locking Fasteners (Ref. 70-00-00, P. Block 201) to check the self-locking features of the fasteners.
(1)Free-spinning locknuts
(a)A free-spinning locknut is a nut that spins freely on the bolt until it contacts the mating surface. Additional torque causes activation of the locking feature. Use the free-spinning torque values specified in Figure (Ref. Fig. 214).
(2)Prevailing torque-type locknuts
(a)A prevailing torque-type locknut is a nut that spins freely on the bolt until the bolt enters the locking portion of the nut. The bolt interferes with the deformed section of the nut to cause a tight frictional hold on the bolt threads. Use the torque values specified in Figure (Ref. Fig. 215), except when nut is on a stud. When the self-locking nut is on a stud, use the free-spinning torque values specified in Figure (Ref. Fig. 214).
NOTE : Helical coil self-locking inserts are categorized as prevailing torque-type locknuts. The torques for bolts used in such inserts are specified in Figure (Ref. Fig. 215).

F. Steel Pipe Plugs in Aluminum and Magnesium Cases (Ref. Fig. 216)
(1)The torque values for steel pipe plugs in aluminum and magnesium cases are specified in Figure (Ref. Fig. 216). These values give sufficient torque to prevent leakage without overstressing the cases. If the pipe plug leaks after the specified torque is applied, do not torque to more than the values specified. Remove the plug, tighten and torque to the specified values again. If necessary, replace the plug with a different one.
(2)When you tighten plugs in a hot engine, reduce the specified torque by 20 percent to allow for the difference in expansion between steel plugs

and aluminum or magnesium cases.

G. Hex-head Straight Threaded Fittings and Plugs (Ref. Fig. 216)
CAUTION : DO NOT APPLY MORE THAN THE SPECIFIED TORQUE. IF YOU DO, YOU CAN CAUSE DAMAGE TO THE THREADS OF THE MATING PARTS.
(1)The torques specified in Figure (Ref. Fig. 216) are based on strength of thread in cast aluminum or magnesium. Use these values in stronger materials also.
NOTE : Do not use a lubricant when a sealing compound is specified.

H. Pratt And Whitney Flexible-Type Fittings and Sealastic-Type Fittings (Ref. Fig. 217)
CAUTION : DO NOT APPLY MORE THAN THE SPECIFIED TORQUE. IF YOU DO, YOU CAN CAUSE DAMAGE TO THE TUBES.
(1)Install the tube with the flexible fitting to the engine. Refer to the specific AMM maintenance task or to Installation of Tubes With Flexible-Type Fittings (Used with Packings and Retainers)(Ref. 70-00-00, P. Block 201).
(2)Fully install the ferrule, packing, and retainer and align the tube before you apply the torque specified in Figure (Ref. Fig. 217).
(3)After you torque the nut to the specified torque, loosen and torque the nut again.
NOTE : The double torque is done to minimize the loss of torque caused by the compression of the rubber to the mating parts over time.

J. Degree Cone Seat Connectors (Ref. Fig. 218)
CAUTION : DO NOT APPLY MORE THAN THE SPECIFIED TORQUE. IF YOU DO, YOU CAN CAUSE DAMAGE TO THE TUBES.
(1)Install the 37 degree cone seat tube to the engine. Refer to the specific AMM maintenance task or to Installation of Tubes With Fixed (Brazed) Conical Seat Ferrules (Ref. 70-00-00, P. Block 201).
(2)For 37 degree conical seat connectors without gaskets, use torque values specified in Figure (Ref. Fig. 218) (Sheet 1/2).
(3)For 37 degree cone seat connectors with nickel gaskets (for example, AS3074 and AS3075) or copper gaskets (for example, AS3072 and AS3073), use torque values specified in Figure (Ref. Fig. 218) (Sheet 2/2).
(4)Do not apply more than the specified torque to correct a leak. Disassemble fitting and check for nicks, burrs, dirt, etc. If necessary, replace the fittings or tubes with different ones.

K. Jamnuts (Ref. Fig. 219)
(1)Use the torque values specified in Figure (Ref. Fig. 219) which are used for all steel and aluminum jamnuts (locknuts) of the type used on fittings for tube and hose connections.
(2)On elbow fittings, torque the jamnut after you align and connect the tube or hose.

L. Concentric Tube Connectors (Double Wall Tubes)
CAUTION : DO NOT APPLY MORE THAN THE SPECIFIED TORQUE. IF YOU DO, YOU CAN CAUSE DAMAGE TO THE TUBES.
(1)Install the double wall tube to the engine as specified in the specific

AMM maintenance task.
(2)Use the antigallant specified in the specific AMM maintenance task.
(3)Use the torque values specified in Figure (Ref. Fig. 220) for the inner and outer tube nuts.
(4)Do not apply more than the specified torque to correct a leak. Disassemble fitting and check for nicks, burrs, dirt, etc. If necessary, replace the fittings or tubes with different ones.

M. Installation and/or Attachment of Various Components of Ignition Systems, Thermocouple Systems, and Electronic Control Systems (Ref. Fig. 221)
(1)Plug-in type threaded connectors
(a)Torque as specified by the specific AMM maintenance task.
(b)Do not apply any thread lubricant.
(2)Igniter plugs
(a)Torque as specified by the specific AMM maintenance task.
(3)Cigarette-type (Ignition) electrical connectors
(a)Torque as specified by the specific AMM maintenance task.
(4)Temperature probe nuts
(a)Do not apply any thread lubricant.
(b)Clean the studs with a soft bristle brush before installation of the nuts.
CAUTION : DO NOT APPLY MORE THAN THE SPECIFIED TORQUE. IF YOU DO, YOU CAN CAUSE DAMAGE TO THE TUBES.
(c)Unless specified differently in the specific AMM task, torque terminal attaching nuts (except Klincher nuts) and thermocouple harness-to-lead attaching screws to limits specified in Figure (Ref. Fig. 221).
(5)Exhaust Gas Temperature (EGT) junction box
CAUTION : DO NOT APPLY MORE THAN THE SPECIFIED TORQUE. IF YOU DO, YOU CAN CAUSE DAMAGE TO THE TUBES.
(a)Torque harness terminal bus bar attaching nuts (except Klincher nuts) specified in Figure (Ref. Fig. 221).
(6)Klincher locknuts
CAUTION : DO NOT APPLY MORE THAN THE SPECIFIED TORQUE. IF YOU DO, YOU CAN CAUSE DAMAGE TO THE TUBES.
(a)Torque free-spinning klincher locknuts to limits specified in Figure (Ref. Fig. 221).

R 14.Assembly and Installation of Fittings

(Ref. Fig. 222)
A. Equipment and Materials

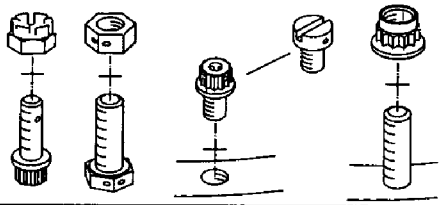
ITEM	DESIGNATION
(1)	None

B. Procedure - Assembly and Installation of Elbow and Positioning Type Fittings (Elbows)
(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
(2)Apply the lubricant to the threads and packing as specified in the

THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)					
	OIL LUBRICATED			ANTI-SEIZE COATED		
	MIN.*		MAX.	MIN.*		MAX.
	TYPE I	TYPE II		TYPE I	TYPE II	
.112 -40	4.5 (0.508)	5 (0.565)	6 (0.678)	3.5 (0.395)	4 (0.452)	4.5 (0.508)
.138 -32	8.5 (0.960)	10 (1.130)	11.5 (1.299)	6.5 (0.734)	7.5 (0.847)	8.5 (0.960)
.164 -32	16 (1.808)	20 (2.260)	22 (2.486)	12.5 (1.412)	15 (1.695)	16.5 (1.864)
.164 -36	18 (2.034)	22 (2.486)	24 (2.712)	13.5 (1.525)	16 (1.808)	18 (2.034)
.190 -24	#23 (2.599)	#27 (3.051)	30 (3.390)	16(1.808)	19.5 (2.203)	21.5 (2.429)
.190 -32	#24 (2.712)	#32 (3.616)	36 (4.067)	19.5 (2.203)	#23 (2.599)	26 (2.938)
.250 -20	#50 (5.649)	#65 (7.344)	70 (7.909)	#37 (4.180)	#45 (5.084)	50 (5.649)
.250 -28	#65 (7.344)	#75 (8.474)	85 (9.604)	#45 (5.084)	#54 (6.101)	60 (6.779)
.3125 -18	#110 (12.428)	#135 (15.253)	150 (16.948)	#80 (9.039)	#95 (10.734)	105 (11.863)
.3125 -24	#125 (14.123)	#150 (16.948)	170 (19.207)	#90 (10.169)	#110 (12.428)	120 (13.558)
.375 -16	#200 (22.597)	#250 (28.246)	270 (30.506)	#140 (15.818)	#170 (19.207)	185 (20.902)
.375 -24	#225 (25.422)	#275 (31.071)	300 (33.895)	#160 (18.078)	#190 (21.467)	215 (24.292)
.4375 -14	325 (36.720)	375 (42.369)	425 (48.019)	#225 (25.422)	270 (30.506)	300 (33.895)
.4375 -20	350 (39.545)	425 (48.019)	475 (53.668)	255 (28.811)	310 (35.025)	340 (38.415)
.500 -13	500 (56.492)	600 (67.791)	650 (73.440)	340 (38.415)	400 (45.194)	450 (50.843)
.500 -20	550 (62.142)	675 (76.265)	750 (84.739)	390 (44.064)	460 (51.973)	515 (58.187)
.5625 -12	700 (79.089)	850 (96.037)	950 (107.336)	500 (56.492)	600 (67.791)	675 (76.265)
.5625 -18	800 (90.388)	950 (107.336)	1050 (118.634)	550 (62.142)	675 (76.265)	750 (84.739)
.625 -11	1000 (112.985)	1200 (135.582)	1300 (146.880)	675 (76.265)	800 (90.388)	900 (101.686)
.625 -18	1150 (129.933)	1350 (152.529)	1500 (169.477)	775 (87.563)	925 (104.511)	1025 (115.809)
.750 -10	1700 (192.074)	2100 (237.268)	2300 (259.865)	1200 (135.582)	1450 (163.828)	1600 (180.776)
.750 -16	2000 (225.970)	2400 (271.164)	2600 (293.760)	1350 (152.529)	1600 (180.776)	1800 (203.373)
.875 -9	2800 (316.357)	3400 (384.148)	3700 (418.044)	1950 (220.320)	2350 (265.514)	2600 (293.760)
.875 -14	3200 (361.551)	3800 (429.342)	4200 (474.536)	2200 (248.567)	2600 (293.760)	2900 (327.656)
1.000 -8	4200 (474.536)	5100 (576.222)	5600 (632.715)	2900 (327.656)	3500 (395.447)	3900 (440.641)
1.000 -12	4800 (542.327)	5800 (655.312)	6400 (723.103)	3200 (361.551)	3850 (434.991)	4300 (485.835)
1.125 -7	5900 (666.610)	7200 (813.491)	7900 (892.580)	4100 (463.238)	4900 (553.626)	5400 (610.118)
1.125 -8	6300 (711.804)	7600 (858.684)	8400 (949.072)	4300 (485.835)	5100 (576.222)	5700 (644.013)
1.250 -7	8400 (949.072)	10100 (1141)	11200 (1265)	5800 (655.312)	6900 (779.595)	7700 (869.983)
1.250 -8	8800 (994.266)	10600 (1197)	11700 (1321)	5900 (666.610)	7100 (802.192)	7900 (892.580)
1.375 -6	11000 (1242)	13300 (1502)	14700 (1660)	7600 (858.684)	9100 (1028)	10100 (1141)
1.375 -8	11900 (1344)	14400 (1626)	15900 (1796)	8000 (903.878)	9500 (1073)	10600 (1197)
1.500 -6	14700 (1660)	17700 (1242)	19600 (2214)	10000 (1129)	12000 (1355)	13300 (1502)
1.500 -8	15800 (1785)	19000 (2146)	21100 (2383)	10500 (1186)	12600 (1423)	14000 (1581)
1.750 -5	23200 (2621)	27900 (3152)	30900 (3491)	15800 (1785)	19000 (2146)	21100 (2383)
1.750 -8	25900 (2926)	31100 (3513)	34500 (3897)	17000 (1920)	20400 (2304)	22700 (2564)
2.000 -4.5	35000 (3954)	42000 (4745)	46600 (5265)	23800 (2689)	28500 (3220)	31700 (3581)
2.000 -8	39500 (4462)	47400 (5355)	52600 (5943)	25800 (2915)	31000 (3502)	34400 (3886)

* USE TYPE I MINIMUM VALUES WHERE ALIGNMENT OF LOCKING HOLES (COTTERPINS, SAFETY WIRE, ETC.) IS REQUIRED AT ASSEMBLY. USE TYPE II MINIMUM VALUES WHERE ALIGNMENT OF LOCKING HOLES IS NOT REQUIRED AT ASSEMBLY.

\# FOR SCREWS WITH SCREWDRIVER SLOTS ONLY (NO EXTERNAL WRENCHING PROVISIONS), 22 lbf-in (2.486 Nm) MINIMUM IS PERMITTED.



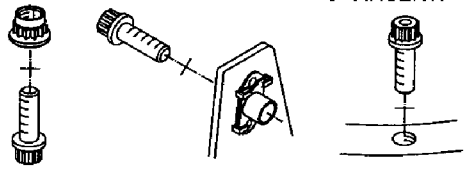
G-11782 (0803)
PW V

BM5 70 00 00 2 KBM0 21

Torques for Free-Spinning Fasteners (Nuts, Bolts or Screws) and for Self-Locking Nuts on Studs
Figure 214

THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)			
	OIL LUBRICATED		ANTI-SEIZE COATED	
	MIN.	MAX.	MIN.	MAX.
.112 -40	6 (0.678)	7 (0.791)	5 (0.565)	6 (0.678)
.138 -32	12 (1.356)	14 (1.582)	9 (1.017)	11 (1.243)
.164 -32	23 (2.599)	26 (2.938)	18 (2.034)	20 (2.260)
.164 -36	25 (2.825)	28 (3.164)	20 (2.260)	22 (2.486)
.190 -24	32 (3.616)	35 (3.954)	24 (2.712)	27 (3.051)
.190 -32	36 (4.067)	40 (4.519)	27 (3.051)	30 (3.390)
.250 -20	# 74 (8.361)	82 (9.265)	# 55 (6.214)	62 (7.005)
.250 -28	# 85 (9.604)	95 (10.734)	# 62 (7.005)	72 (8.135)
.3125 -18	# 160 (18.078)	175 (19.772)	# 115 (12.993)	130 (14.688)
.3125 -24	# 180 (20.337)	200 (22.597)	# 125 (14.123)	140 (15.818)
.375 -16	# 270 (30.506)	300 (33.895)	# 200 (22.597)	220 (24.857)
.375 -24	# 290 (32.766)	325 (36.720)	# 225 (25.422)	250 (28.246)
.4375 -14	420 (47.454)	465 (52.538)	315 (35.590)	350 (39.545)
.4375 -20	450 (50.843)	500 (56.492)	340 (38.415)	380 (42.934)
.500 -13	630 (71.180)	700 (79.089)	450 (50.843)	500 (56.492)
.500 -20	720 (81.349)	800 (90.388)	515 (58.187)	575 (64.966)
.5625 -12	950 (107.336)	1050 (118.634)	675 (76.265)	750 (84.739)
.5625 -18	1050 (118.634)	1150 (129.933)	750 (84.739)	825 (93.212)
.625 -11	1250 (141.231)	1400 (158.179)	900 (101.686)	1000 (112.985)
.625 -18	1450 (163.828)	1600 (180.776)	1030 (116.374)	1150 (129.933)
.750 -10	2200 (248.567)	2450 (276.813)	1600 (180.776)	1750 (197.723)
.750 -16	2500 (282.462)	2750 (310.708)	1750 (197.723)	1950 (220.320)
.875 -9	3600 (406.745)	4000 (451.939)	2500 (282.462)	2850 (322.007)
.875 -14	4000 (451.939)	4450 (502.782)	2800 (316.357)	3100 (350.253)
1.000 -8	5400 (610.118)	6000 (677.909)	3800 (429.342)	4200 (474.536)
1.000 -12	6000 (677,909)	6700 (756.998)	4000 (451.939)	4500 (508.432)
1.125 -7	7600 (858.684)	8200 (926.475)	5300 (598.819)	5700 (644.013)
1.125 -8	8000 (903.878)	8700 (982.968)	5500 (621.416)	6000 (677.909)
1.250 -7	10500 (1186)	11600 (1310)	7300 (824.789)	8100 (915.177)
1.250 -8	11000 (1242)	12100 (1367)	7500 (847.386)	8300 (937.774)
1.375 -6	13800 (1559)	15100 (1706)	9600 (1084)	10500 (1186)
1.375 -8	14900 (1683)	16300 (1841)	10000 (1129)	11000 (1242)
1.500 -6	18200 (2056)	20100 (2270)	12500 (1412)	13800 (1559)
1.500 -8	19500 (2203)	21600 (2440)	13100 (1480)	14500 (1638)
1.750 -5	28500 (3220)	31500 (3559)	19600 (2214)	21700 (2451)
1.750 -8	31700 (3581)	35100 (3965)	21000 (2372)	23300 (2632)
2.000 -4.5	42800 (4835)	47400 (5355)	29300 (3310)	32500 (3672)
2.000 -8	48200 (5445)	53400 (6033)	31800 (3592)	35200 (3977)

FOR SCREWS WITH SCREWDRIVER SLOTS ONLY (NO EXTERNAL WRENCHING PROVISIONS), THE MINIMUM PERMITTED TORQUE IS 22 lbf-in (2.486 Nm), PLUS THE TORQUE NECESSARY TO TURN THE SCREW THROUGH THE NUT OR SELF-LOCKING HELICAL COIL INSERT.



G-11783 (0803)
PW V

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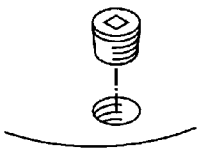
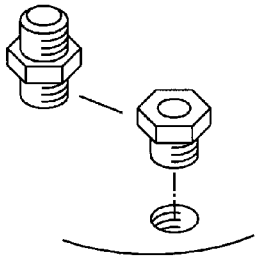
Torques For Self-Locking Fasteners, Free Running Bolts and Screws Used in Self-Locking Helical Coil Inserts
Figure 215



THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)	
	ANPT OR NPT, OIL LUBRICATED *	
	MIN.	MAX.
.062	30 (3.390)	40 (4.519)
.125	30 (3.390)	40 (4.519)
.250	70 (7.909)	85 (9.604)
.375	95 (10.734)	110 (12.428)
.500	140 (15.818)	160 (18.078)
.750	210 (23.727)	230 (25.987)
1.000	285 (32.201)	315 (35.590)
1.250	355 (40.110)	385 (43.499)

* WHERE SEALING COMPOUNDS ARE USED, OMIT OIL LUBRICATION.

TORQUES FOR STEEL PLUGS IN ALUMINUM AND MAGNESIUM

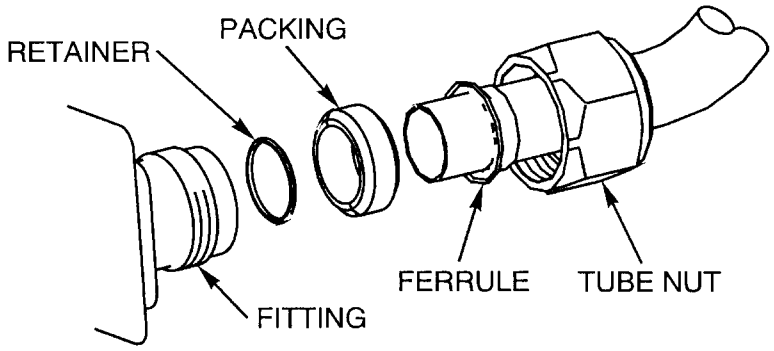


THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)			
	OIL LUBRICATED		ANTI-SEIZE COATED	
	MIN.	MAX.	MIN.	MAX.
.250-28	15 (1.695)	20 (2.260)	10 (1.130)	13 (1.469)
.3125-24	35 (3.954)	40 (4.519)	23 (2.599)	26 (2.938)
.375-24	40 (4.519)	50 (5.649)	26 (2.938)	33 (3.728)
.4375-20	65 (7.344)	75 (8.474)	42 (4.745)	49 (5.536)
.500-20	90 (10.169)	100 (11.298)	58 (6.553)	65 (7.344)
.5625-18	110 (12.428)	120 (13.558)	70 (7.909)	80 (9.039)
.625-18	150 (16.948)	170 (19.207)	95 (10.734)	110 (12.428)
.750-16	200 (22.597)	225 (25.422)	130 (14.688)	145 (16.383)
.8125-16	225 (25.422)	250 (28.246)	145 (16.383)	160 (18.078)
.875-14	250 (28.246)	275 (31.071)	160 (18.078)	175 (19.772)
1.000-12	275 (31.071)	300 (33.895)	175 (19.772)	190 (21.467)
1.0625-12	375 (42.369)	425 (48.019)	240 (27.116)	270 (30.506)
1.125-12	415 (46.889)	495 (55.927)	255 (28.811)	300 (33.895)
1.1875-12	450 (50.843)	550 (62.142)	285 (32.201)	350 (39.545)
1.250-12	500 (56.492)	600 (67.791)	315 (35.590)	380 (42.934)
1.3125-12	525 (59.317)	625 (70.616)	330 (37.285)	395 (44.629)
1.500-12	600 (67.791)	700 (79.089)	375 (42.369)	440 (49.713)
1.625-12	650 (73.440)	750 (84.739)	400 (45.194)	470 (53.103)
1.750-12	650 (73.440)	750 (84.739)	400 (45.194)	470 (53.103)
1.875-12	650 (73.440)	750 (84.739)	400 (45.194)	470 (53.103)
2.250-12	650 (73.440)	750 (84.739)	400 (45.194)	470 (53.103)
2.500-12	650 (73.440)	750 (84.739)	400 (45.194)	470 (53.103)

BM5 70 00 00 2 KFM0 20

TORQUES FOR HEX-HEAD STRAIGHT THREADED FITTINGS AND PLUGS G-11784 (0802)
PW V

Torques For Steel Pipe Plugs (Aluminum and Magnesium),
Hex-Head, Straight Threaded Fittings and Plugs
Figure 216

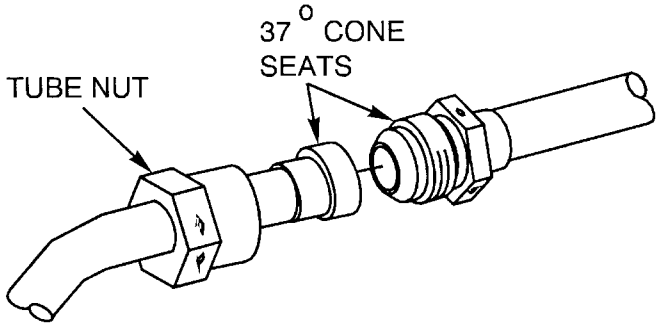


TUBE DIAMETER (INCH)	THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)			
		FOR 75 DUROMETER A PACKINGS: AMS 7260, 7267, 7273, OR 7276		FOR 77 DUROMETER C (100 DUROMETER A) PACKINGS: PWA-401	
		MIN.	MAX.	MIN.	MAX.
.125	.4375-24	25 (2.825)	30 (3.390)	55 (6.214)	60 (6.779)
.1875	.500-20	25 (2.825)	30 (3.390)	55 (6.214)	60 (6.779)
.250	.625-18	25 (2.825)	30 (3.390)	55 (6.214)	60 (6.779)
.3125	.6875-16	30 (3.390)	35 (3.954)	65 (7.344)	70 (7.909)
.375	.750-16	30 (3.390)	35 (3.954)	65 (7.344)	70 (7.909)
.4375	.8125-16	45 (5.084)	50 (5.649)	90 (10.169)	100 (11.298)
.500	.875-14	55 (6.214)	60 (6.779)	110 (12.428)	120 (13.558)
.5625	1.000-12	60 (6.779)	65 (7.344)	120 (13.558)	130 (14.688)
.625	1.0625-12	65 (7.344)	70 (7.909)	130 (14.688)	140 (15.818)
.750	1.1875-12	70 (7.909)	80 (9.039)	140 (15.818)	160 (18.078)
.875	1.375-12	75 (8.474)	85 (9.604)	150 (16.948)	170 (19.207)
1.000	1.1500-12	100 (11.298)	110 (12.428)	200 (22.597)	220 (24.857)
1.125	1.625-12	100 (11.298)	110 (12.428)	200 (22.597)	220 (24.857)
1.250	1.750-12	100 (11.298)	110 (12.428)	200 (22.597)	220 (24.857)
1.500	2.125-12	100 (11.298)	110 (12.428)	200 (22.597)	220 (24.857)

BM5 70 00 00 2 KHM0 20

G-11785 (0802)
PW V

Torques For Pratt & Whitney Flexible Fittings
Figure 217



HOSE SIZE	TUBING OD (INCH)	THREAD SIZE (INCH)	TORQUE, lbf-in (Nm) *					
			ALUMINUM FITTINGS **		STEEL FITTINGS		STEEL FITTINGS	
							TITANIUM FITTINGS ***	
			ALL LUBRICANTS		OIL LUBRICATED		ANTI-SEIZE COATED	
			MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
- 3	.1875	.375-24	30 (3.390)	50 (5.649)	70 (7.909)	80 (9.039)	50 (5.649)	60 (6.779)
- 4	.250	.4375-20	40 (4.519)	65 (7.344)	90 (10.169)	100 (11.298)	65 (7.344)	75 (8.474)
- 5	.3125	.500-20	60 (6.779)	80 (9.039)	135 (15.253)	150 (16.948)	100 (11.298)	110 (12.428)
- 6	.375	.5625-18	75 (8.474)	125 (14.123)	270 (30.506)	300 (33.895)	200 (22.597)	225 (25.422)
- -	.4375	.625-18	100 (11.298)	175 (19.772)	320 (36.155)	350 (39.545)	225 (25.422)	250 (28.246)
- -	- -	.6875-24	- -	- -	320 (36.155)	350 (39.545)	225 (25.422)	250 (28.246)
- 8	.500	.750-16	150 (16.948)	250 (28.246)	450 (50.843)	500 (56.492)	340 (38.415)	375 (42.369)
- -	.5625	.8125-16	175 (19.772)	300 (33.895)	550 (62.142)	600 (67.791)	400 (45.194)	450 (50.843)
- 10	.625	.875-14	200 (22.597)	350 (39.545)	650 (73.440)	700 (79.089)	475 (53.668)	525 (59.317)
- -	- -	.875-16	200 (22.597)	350 (39.545)	650 (73.440)	700 (79.089)	475 (53.668)	525 (59.317)
- -	.6875	1.000-12	275 (31.071)	450 (50.843)	800 (90.388)	900 (101.686)	600 (67.791)	675 (76.265)
- -	- -	1.000-14	275 (31.071)	450 (50.843)	800 (90.388)	900 (101.686)	600 (67.791)	675 (76.265)
- 12	.750	1.0625-12	300 (33.895)	500 (56.492)	900 (101.686)	1000 (112.985)	675 (76.265)	750 (84.739)
- -	.875	1.1875-12	400 (45.194)	600 (67.791)	1100 (124.283)	1200 (135.582)	825 (93.212)	900 (101.686)
- -	- -	1.250-12	400 (45.194)	650 (73.440)	1150 (129.933)	1300 (146.880)	900 (101.686)	1000 (112.985)
- 16	1.000	1.3125-12	500 (56.492)	700 (79.089)	1300 (146.880)	1400 (158.179)	950 (107.336)	1050 (118.634)
- -	1.125	1.500-12	600 (67.791)	900 (101.686)	1500 (169.477)	1600 (180.776)	1050 (118.634)	1200 (135.582)
- 20	1.250	1.625-12	600 (67.791)	900 (101.686)	1700 (192.074)	1800 (203.373)	1150 (129.933)	1300 (146.880)
- 24	1.500	1.875-12	600 (67.791)	900 (101.686)	2100 (237.268)	2200 (248.567)	1500 (169.477)	1600 (180.776)

* IF THE NUT OR EITHER OF THE MATING SEALING SURFACES IS ALUMINUM, THE REQUIRED TORQUE LIMITS FOR ALUMINUM FITTINGS APPLY.

** FOR THRUST REVERSER AIR LINE FITTINGS, USE TORQUES FOR ALUMINUM FITTINGS, REGARDLESS OF MATERIAL, UNLESS OTHERWISE SPECIFIED.

*** FOR MIXED MATERIAL ASSEMBLY (STEEL CONNECTOR WITH TITANIUM CONNECTOR WITH STEEL NUT), USE TITANIUM TORQUE.

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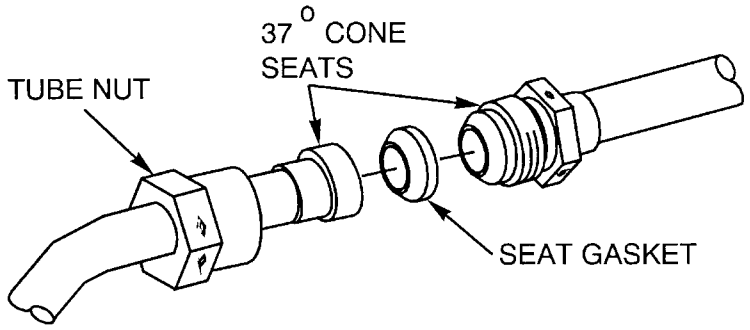
G-11786 (0802)
PW V

Torques For 37 Degree Cone Seat Connectors (With Nickel or Copper Gaskets) (Sheet 1/2)
Figure 218



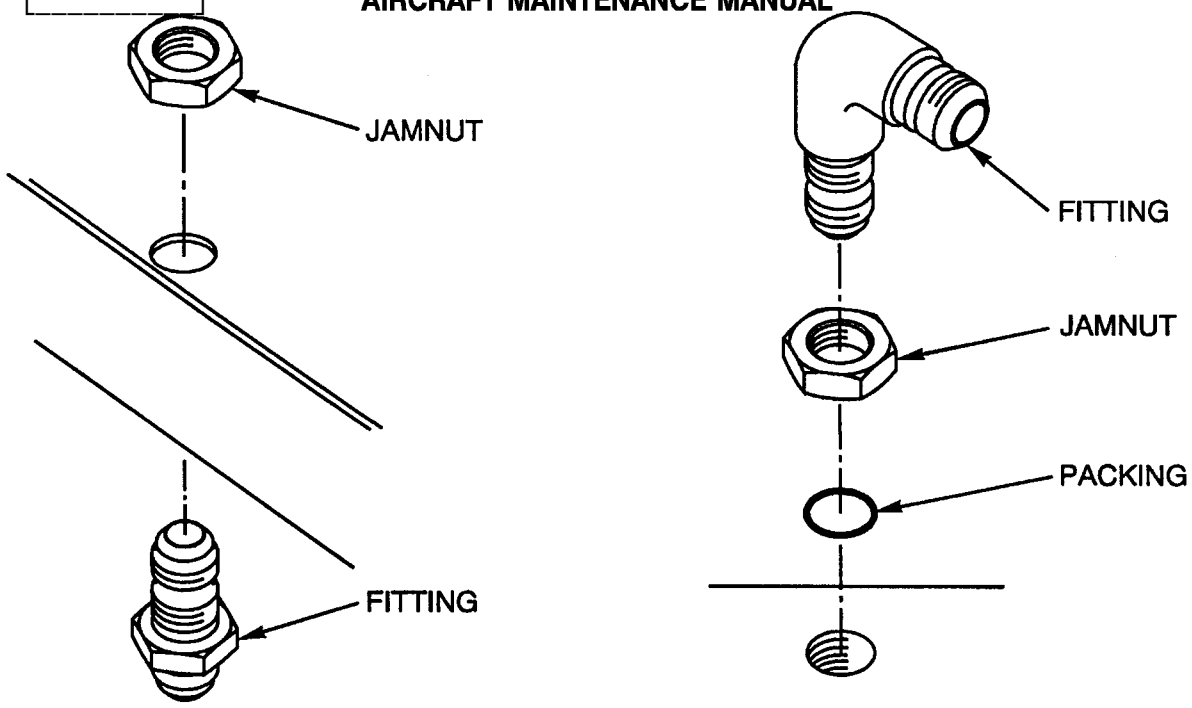
HOSE SIZE	TUBING OD (INCH)	THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)					
			STEEL FITTINGS *				TITANIUM FITTINGS *	
			OIL LUBRICATED		ANTI-SEIZE COATED		ANTI-SEIZE COATED	
			MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
- 3	.1875	.375-24	50 (5.649)	60 (6.779)	40 (4.519)	45 (5.084)	50 (5.649)	60 (6.779)
- 4	.250	.4375-20	90 (10.169)	100 (11.298)	65 (7.344)	75 (8.474)	90 (10.169)	100 (11.298)
- 5	.3125	.500-20	135 (15.253)	150 (16.948)	100 (11.298)	110 (12.428)	120 (13.558)	135 (15.235)
- 6	.375	.5625-18	200 (22.597)	220 (24.857)	150 (16.948)	165 (18.642)	135 (15.253)	150 (16.948)
- -	.4375	.625-18	250 (28.246)	270 (30.506)	185 (20.902)	200 (22.597)	250 (28.246)	270 (30.506)
- 8	.500	.750-16	350 (39.545)	400 (45.194)	270 (30.506)	300 (33.895)	350 (39.545)	400 (45.194)
- -	.5625	.8125-16	400 (45.194)	450 (50.843)	300 (33.895)	350 (39.545)	400 (45.194)	450 (50.843)
- 10	.625	.875-14	500 (56.492)	550 (62.142)	360 (40.675)	400 (45.194)	500 (56.492)	550 (62.142)
- -	.6875	1.000-12	600 (67.791)	700 (79.089)	480 (54.233)	530 (59.882)	600 (67.791)	700 (79.089)
- 12	.750	1.0625-12	700 (79.089)	800 (90.388)	540 (61.012)	600 (67.791)	700 (79.089)	800 (90.388)
- -	.875	1.1875-12	800 (90.388)	900 (101.686)	600 (67.791)	675 (76.265)	800 (90.388)	900 (101.686)
- 16	1.000	1.3125-12	1000 (112.985)	1100 (124.283)	750 (84.739)	825 (93.212)	1000 (112.985)	1100 (124.283)
- -	1.125	1.500-12	1300 (146.880)	1400 (158.179)	900 (101.686)	1000 (112.985)	1300 (146.880)	1400 (158.179)
- 20	1.250	1.625-12	1400 (158.179)	1500 (169.477)	1000 (112.985)	1100 (124.283)	1400 (158.179)	1500 (169.477)
- 24	1.500	1.875-12	1600 (180.776)	1700 (192.074)	1200 (135.582)	1300 (146.880)	1600 (180.776)	1700 (192.074)

* FOR MIXED MATERIAL ASSEMBLY (STEEL CONNECTOR WITH TITANIUM NUT OR TITANIUM CONNECTOR WITH STEEL NUT) USE TITANIUM TORQUE.

BM5 70 00 00 2 KKMM 00

G-11787 (0802)
PW V

Torques For 37 Degree Cone Seat Connectors (With Nickel or Copper Gaskets) (Sheet 2/2)
Figure 218

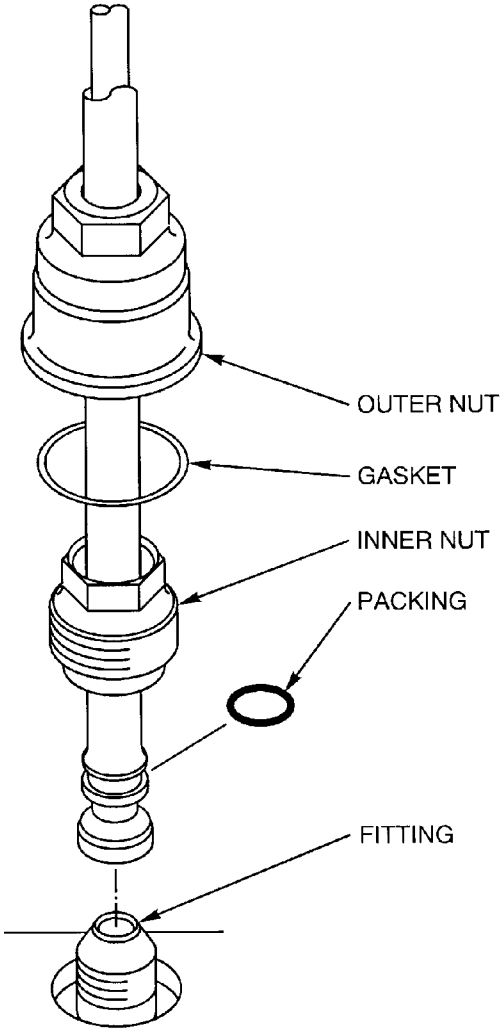


THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)	
	MIN.	MAX.
.250-28	14 (1.582)	16 (1.808)
.3125-24	22 (2.486)	24 (2.712)
.375-24	28 (3.164)	32 (3.616)
.4375-20	38 (4.293)	42 (4.745)
.500-20	58 (6.553)	62 (7.005)
.5625-18	70 (7.909)	80 (9.039)
.625-18	95 (10.734)	105 (11.863)
.750-16	145 (16.383)	155 (17.513)
.8125-16	165 (18.642)	185 (20.902)
.875-14	190 (21.467)	210 (23.727)
1.000-12	260 (29.376)	290 (32.766)
1.0625-12	285 (32.210)	315 (35.590)
1.1875-12	350 (39.545)	390 (44.064)
1.250-12	380 (42.934)	420 (47.454)
1.3125-12	475 (53.668)	525 (59.317)
1.500-12	570 (64.401)	630 (71.180)
1.625-12	570 (64.401)	630 (71.180)
1.875-12	570 (64.401)	630 (71.180)
2.250-12	570 (64.401)	630 (71.180)
2.500-12	570 (64.401)	630 (71.180)

BM5 70 00 00 2 KMM0 21

G-00527 (0203)
PW V

Torques For Jamnuts
Figure 219

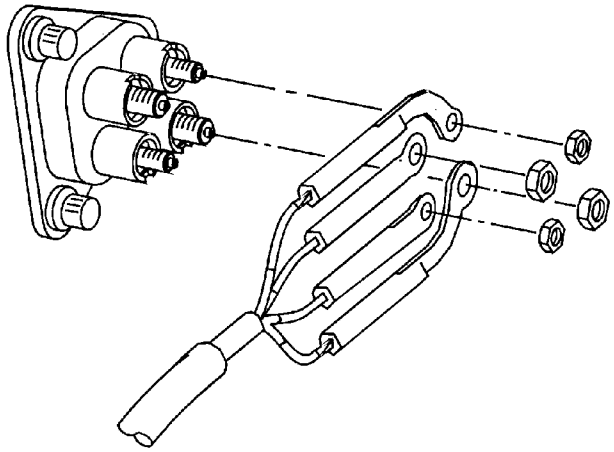


INNER NUT			OUTER NUT		
THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)		THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)	
	MIN.	MAX.		MIN.	MAX.
.750-16	340 (38.415)	375 (42.369)	1.1875-12	290 (32.766)	340 (38.415)
.8125-16	400 (45.194)	450 (50.843)	1.1875-12	290 (32.766)	340 (38.415)
.9375-12	525 (59.317)	600 (67.791)	1.375-8	370 (41.804)	420 (47.454)
1.750-12	1325 (149.705)	1450 (163.828)	2.375-8	1055 (119.199)	1130 (127.673)

BM5 70 00 00 2 KQM0 20

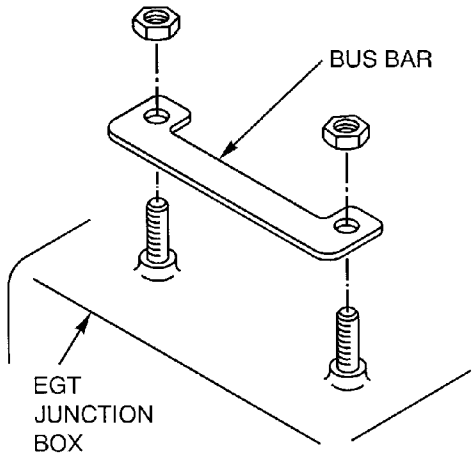
G-11788 (0802)
PW V

Torques For Concentric Tube Connectors (Double Wall Tubes)
Figure 220



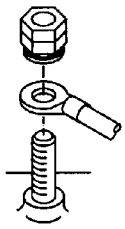
THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)	
	MIN.	MAX.
.138-32	8 (0.904)	10 (1.130)
.164-32	15 (1.695)	18 (2.034)
.190-32	18 (2.034)	22 (2.486)
.216-32	30 (3.390)	35 (3.954)
.250-32	35 (3.954)	40 (4.519)

TORQUES FOR TEMPERATURE PROBE NUTS - NO LUBRICATION



THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)	
	MIN.	MAX.
.164-32	20 (2.260)	25 (2.825)
.190-32	25 (2.825)	30 (3.390)

TORQUES FOR HARNESS TERMINAL AND BUS BAR NUTS - OIL LUBRICATION



THREAD SIZE (INCH)	TORQUE, lbf-in (Nm)	
	MIN.	MAX.
.164-32	15 (1.695)	20 (2.260)
.190-32	24 (2.712)	40 (4.519)

TORQUES FOR KLINCHER NUTS

BM5 70 00 00 2 KSM0 20

G-11789 (0802)
PW V

Torques For Nuts on Electrical Studs
Figure 221

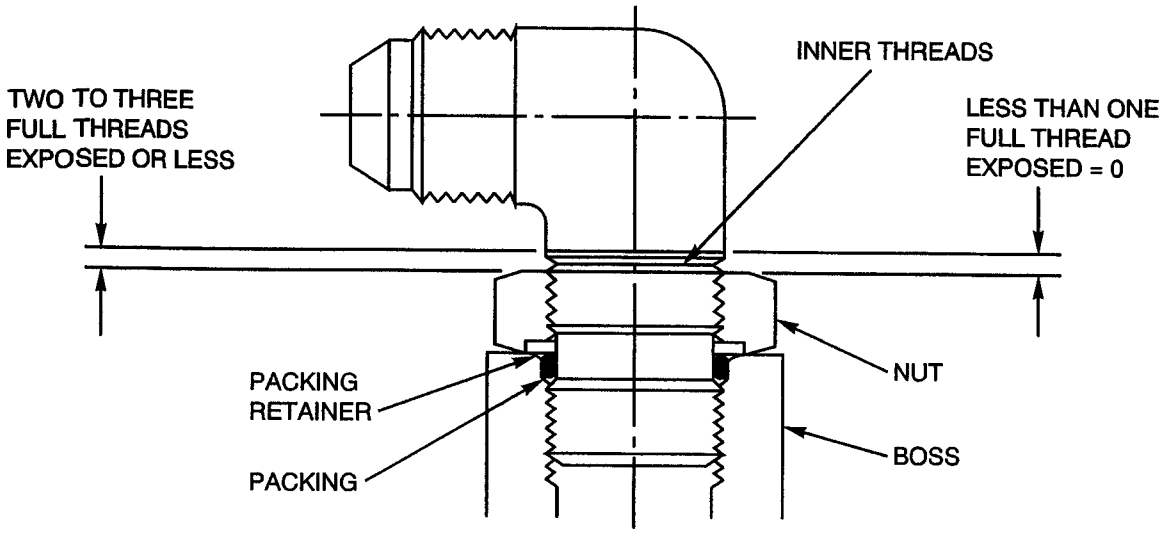
specific AMM maintenance task.
(3)Install the jamnut to the second set of threads on the elbow.
(4)Install the retainer and packing to the area between the two sets of threads.
(5)Turn the nut out only until the packing touches the first set of threads.
(6)Install the fitting assembly to the boss until the packing is in the beveled portion of the threaded hole.
NOTE : You will turn the fitting and the nut together so that the nut does not turn in relation to the fitting. You will feel an increase in torque when the packing is in the correct position.
(7)While you hold the nut, turn the fitting clockwise into the boss one and one-half turns.
(8)While you hold the nut, turn the fitting no more than one-half turn to align the tube, hose, or manifold.
CAUTION : BEFORE YOU TIGHTEN THE JAMNUT, INSTALL THE TUBE, HOSE OR MANIFOLD HANDTIGHT TO MAKE SURE THAT THE ELBOW FITTING IS CORRECTLY ALIGNED. IF YOU DO NOT DO THIS, YOU CAN CAUSE STRESS TO THE TUBE AND SUBSEQUENT DAMAGE.
(9)With the elbow correctly aligned, torque the jamnut as specified in the specific AMM maintenance task or the Standard Torques (Ref. 70-00-00, P. Block 201).

R 15.Installation of Electrical Harnesses, Leads and Cables

A. Equipment and Materials

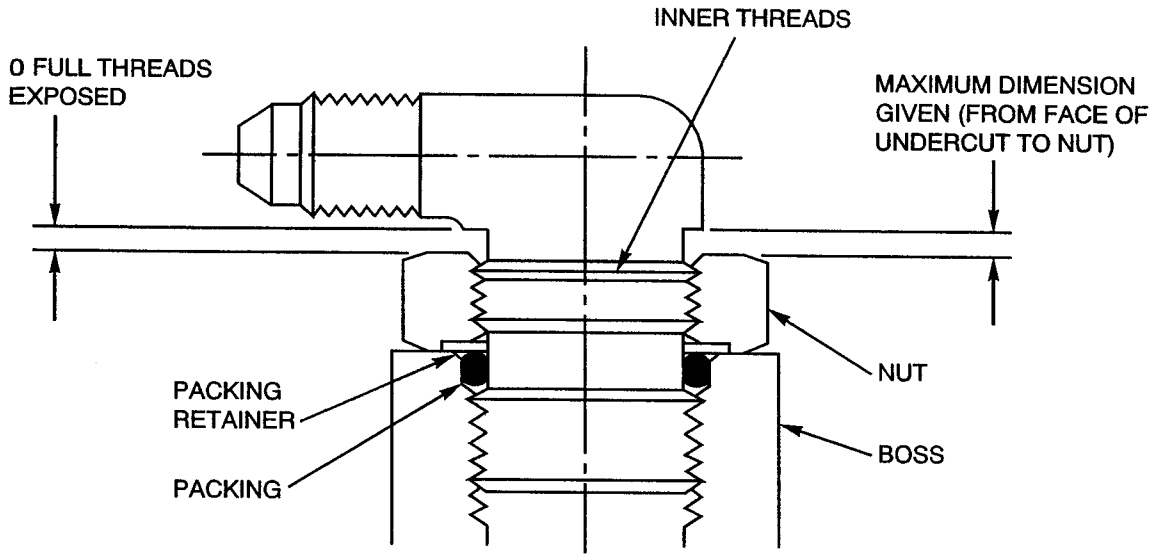
ITEM	DESIGNATION
(1)	Glenair (Electrical Connector) Soft Jaw Pliers - TG-69
(2)	Glenair (Electrical Connector) Strap Wrench - TG-70

B. Procedure - General Harness Installation Instructions
(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
CAUTION : REMOVE THE PROTECTION COVERS FROM THE OPENINGS AS NECESSARY TO PREVENT ENGINE DAMAGE.
(2)Make sure that you remove protection covers as necessary to prevent engine damage.
(3)Examine each harness electrical connector and the mating component receptacle as follows.
(a)Examine for broken, bent, or corroded pins.
(b)Examine for arcing between the pins or sockets.
(c)Examine the threads.
(d)Examine the backshells and backshell clamps for damage and tightness.
(4)Clean the electrical harness connectors and the contacts. Refer to Cleaning of Electrical Harnesses and Contact Points (SPOP 6) (Ref. 70-00-00, P. Block 201).
(5)Examine the harness wires for cracks, wear, or breaks.
CAUTION : DO NOT BEND OR TWIST THE HARNESS TOO MUCH. IF YOU DO,



TYPICAL POSITION AFTER INSTALLATION
(STANDARD FITTING)

(THREADS EXPOSED = 1/2
$\frac{0+1}{2} = 1/2$)



TYPICAL POSITION AFTER INSTALLATION
(UNDERCUT FITTING)

G-00536 (0503)
PW V

BM5 70 00 00 2 KJN0 00

Assembly and Installation of Fittings
Figure 222

DAMAGE TO THE HARNESS CAN OCCUR.

CAUTION : DO NOT TIGHTEN THE CLAMPS UNTIL YOU CONNECT ALL ELECTRICAL CONNECTORS AND THE HARNESS IS IN THE CORRECT POSITION. IF YOU DO NOT DO THIS, DAMAGE TO THE HARNESS CAN OCCUR.

CAUTION : DO NOT LET THE WEIGHT OF THE HARNESS HANG ON THE CONNECTORS. IF YOU DO, DAMAGE TO THE HARNESS CAN OCCUR.

(6)Install the wiring harness assembly as follows.

(a)Put the harness in position on the engine as follows.

1 Start at the top, continue to work down and around the engine, and put the harness in position on any hinge clamps, block clamps, or brackets as applicable.

a Do not twist the harness.

b Do not close or tighten any clamps at this time.

(7)Connect the self-locking (MIL-C-26500 or MIL-C-38999) harness electrical connectors to the mating components as follows.

CAUTION : USE THE CORRECT ASSEMBLY PROCEDURE AND TOOLS FOR THE HARNESS CONNECTOR INSTALLATION. IF YOU DO NOT, A DAMAGED OR LOOSE CONNECTOR CAN OCCUR. A LOOSE CONNECTOR CAN AFFECT ENGINE OPERATION, LIGHTENING PROTECTION, AND CAUSE AN IN FLIGHT SHUTDOWN.

(a)Examine, align, and engage the connector.

(b)Push lightly inward on the connector while tightening the coupling ring.

(c)Use the Glenair TG-69 Soft Jaw Pliers or the Glenair TG-70 Strap Wrench and tighten the connector against the receptacle.

(d)While you tighten, push the connector in and from side to side.

(e)Make sure you can feel the ratchet feature.

(f)Tighten the connector until the pliers or strap wrench slip on the connector ring.

(g)Make sure that you cannot tighten the connector more.

NOTE : When you use these tools correctly, the contacts are sufficiently engaged and the connector is tight. If you use too much force, these tools will turn on the connector coupling nut. (This is to protect the connector from too much torque).

(8)Connect other types of harness electrical connectors to the mating components as follows.

CAUTION : USE THE CORRECT ASSEMBLY PROCEDURE AND TOOLS FOR THE HARNESS CONNECTOR INSTALLATION. IF YOU DO NOT, A DAMAGED OR LOOSE CONNECTOR CAN OCCUR. A LOOSE CONNECTOR CAN AFFECT ENGINE OPERATION LIGHTENING PROTECTION, AND CAUSE AN IN FLIGHT SHUTDOWN.

(a)Examine, align, and engage the connector.

(b)Push lightly inward on the connector while tightening the coupling ring.

(c)Use the Glenair TG-69 Soft Jaw Pliers or the Glenair TG-70 Strap Wrench and tighten the connector against the receptacle.

(d)While you tighten, push the connector in and from side to side.

(e)Tighten the connector until the pliers or strap wrench slip on the connector ring.

(f)Make sure that you cannot tighten the connector more.

NOTE : When you use these tools correctly, the contacts are suffi-

ciently engaged and the connector is tight. If you use too much force, these tools will turn on the connector coupling nut. (This is to protect the connector from too much torque).

(g)If necessary, torque the connector as specified in the specific AMM maintenance task.

(h)If necessary, safety the connector coupling ring.

(9)Attach the harness to the engine as follows.

(a)Adjust the harness in the hinged clamps, loop clamps, and block clamps to remove any stress (too loose or too tight) and make sure of the clearances to adjacent hardware.

(b)Distribute the slack in the harness equally.

(c)Make a large radius where the harness changes direction.

(d)Attach the harness to the engine with the applicable hinged clamps, loop clamps, and block clamps as applicable.

(e)Torque the clamp bolts.

(10)Examine the assembly for foreign objects, damage, and correct assembly.

R 16.Application of Antigalling and Antiseize Compounds

A. Equipment and Materials

ITEM	DESIGNATION
(1)Material No. P03-002	Oils (Ref. 70-00-00)
R (2)Material No. P06-009	Lubricants (Ref. 70-00-00)
R (3)Material No. P06-017	Lubricants (Ref. 70-00-00)
R (4)Material No. P06-038	Lubricants (Ref. 70-00-00)

B. Procedure - General Instructions

R CAUTION : IT IS VERY IMPORTANT TO APPLY ANTIGALLING AND ANTI-SEIZE COMPOUNDS IN A SMOOTH, THIN LAYER AND TO FULLY REMOVE ALL MATERIAL THAT IS NOT NECESSARY. THIS REMOVAL PREVENTS CONTAMINATION IN OR ON PARTS, PASSAGES, OR SURFACES WHERE THE MATERIAL CAN CAUSE MALFUNCTION OR EVEN FAILURE OF THE ENGINE.

R (1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.

R (2)Use antigalling and anti-seize compounds only when they are specified in assembly instructions.

R (3)When necessary, you can apply anti-seize compounds at assembly as an aid in the disassembly of some hot section and free turbine threaded fittings. Apply such compounds only when specified by assembly or maintenance instructions.

R (4)Use SPOP 427 penetrating oil at disassembly as an aid in the removal of screws, nuts, and bolts (Ref. 70-00-00, P. Block 201).

R NOTE : Penetration oil prevents damage (for example, breaking or stripping) of the fastening hardware.

R (5)Do not apply oil if you applied and antigalling or anti-seize compound during a repair or an assembly procedure.

R C. Procedure - Materials

R (1)Always obey the specific procedures and limits in the specific AMM

R maintenance tasks.
R (2)Antiseize lubricant (Material No.P06-017), a mixture of molybdenum disulfide powder and grade 1010 oil, is satisfactory to use in some assembly procedures when specified. The make-up of Antiseize lubricant (Material No.P06-017) follows :
R (a)Fully mix the Antiseize compound (molybdenum disulfide powder) and lubricating oil (grade 1010) in these proportions :
R 1 Antiseize compound (Material No.P06-009) :
R 80% +/- 3% by weight.
R 2 Lubricating oil (Material No.P03-002) :
R 20% +/- 3% by weight.
R (b)Continue to mix until the lubricant is smooth, and without lumps, cakes, skins, and grit.
R (c)Keep the lubricant in closed containers to prevent contamination.
R (3)Heat can cause a yellow-white color to show on bolts, brackets, nuts, and nut plates that have a layer of a molybdenum disulfide-type dry film lubricant on them.
R NOTE : Antigallant compound (Material No.P06-038) is an example of a molybdenum disulfide-type dry film lubricant.
R (a)This yellow-white color occurs because the molybdenum disulfide lubricant in the antigalling compound oxidizes to a molybdenum trioxide compound.
R NOTE : Antigallant compound (Material No.P06-038) is an example of a molybdenum disulfide-type dry film lubricant.
R (b)This oxidation can start as low as 750°F (399°C) but increases quickly at temperatures higher than 900°F (482°C).
R (c)The molybdenum trioxide compound is not harmful to the structure or function of the parts.
R (d)Pratt & Whitney laboratory analysis tests show that this compound does not cause corrosion.

R D. Torque Requirements
R (1)The torque values, shown in Standard Torques (Ref. 70-00-00, P. Block 201), include limits for parts lubricated with anti-seize compounds.

R 17.Application of Sealing Compounds

A. Equipment and Materials

ITEM	DESIGNATION
(1)Material No.P04-005	Common Greases (Ref. 70-00-00)
(2)Material No.P06-014	Lubricants (Ref. 70-00-00)
(3)Material No.P09-003	Sealants (Ref. 70-00-00)
(4)Material No.P09-005	Sealants (Ref. 70-00-00)
(5)Material No.P09-006	Sealants (Ref. 70-00-00)
(6)Material No.P09-007	Sealants (Ref. 70-00-00)
(7)Material No.P09-008	Sealants (Ref. 70-00-00)
(8)Material No.P09-009	Sealants (Ref. 70-00-00)

B. Procedure - General Instructions
(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
CAUTION : DO NOT USE SEALING COMPOUNDS AS AN ALTERNATIVE TO CORRECTLY FINISHED PARTS, GOOD ASSEMBLY PROCEDURES, OR ACCURATE DIMENSIONS.
(2)Sealing compounds are available to be used on threaded, metal-to-metal, and mating surfaces with gaskets.
(3)Clean all unwanted materials such as oil, grease or gasket material from mating surfaces before applying sealant compound. Refer to Degrease Parts by Solvent Wipe (SPOP 208) (Ref. 70-00-00, P. Block 201).
(4)Apply a thin layer of sealing compound to both mating surfaces.
(5)Always remove unwanted sealing compound to prevent subsequent damage to the engine.

C. Material Usage
(1)Sealing Compound (Material No.P09-005) is for use on threaded fittings.
(2)Sealing Compound (Material No.P09-006) is for use on metal-to-metal mating surfaces.
CAUTION : DO NOT USE SILICONE RUBBER SEALANT (MATERIAL NO.P09-003) NEAR SILICONE RUBBER OR ELECTRICAL CONNECTORS.
(3)Silicone Rubber Sealant (Material No.P09-003) is for use on threaded fittings and metal-to-metal surfaces.
NOTE : You can use Silicone Rubber Sealant (Material No.P09-003) on gasket surfaces to keep the bond with mating surfaces to a minimum or to prevent small amount of leakage.
(4)Sealing Compound (Material No.P09-007) and Sealing Compound (Material No. P09-009) are for use on threaded fittings and metal-to-metal mating surfaces.
(5)Sealing Compound (Material No.P09-008) is for use on threaded permanent plugs and inserts.
(6)Gasket Lubricant (Material No.P06-014) and Grease (Material No.P04-005) are for use on gasket surfaces to keep bonds to a minimum, or to prevent small amounts of leakage.

D. Compound Usage limits
(1)Unless specified, do not use sealing compounds at the locations which follow :
(a)All connections in the engine fuel system
(b)All splined assemblies
(c)All metallic oil seal rings and oil ring carrier grooves
(d)Any parts which move in relation to another part during engine operation.

R 18.Application of Gasket Lubricant

A. Equipment and Materials

ITEM	DESIGNATION
(1)Material No.P06-014	Lubricants (Ref. 70-00-00)

B. Procedure - General Instructions
(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
(2)Degrease the mating surfaces. Refer to Degrease Parts by Solvent Wipe (SPOP 208) (Ref. 70-00-00, P. Block 201).
(3)Apply a thin layer of the Gasket Lubricant (Material No.P06-014) to the surface of the gasket.

R 19.Identification of Nuts and Bolts

A. Equipment and Materials

ITEM	DESIGNATION
(1)None	

B. Procedure - Nut and Bolt Identification General Information
(1)Permanent material codes used on engine hardware are important for the safety of the engine. Refer to the Illustrated Parts Catalogs for part numbers and the equivalent manufacturer's numerical code identification.

C. Material Code System Used on AN, MS, And AS/Company Parts
CAUTION : USE PARTS THAT HAVE EITHER NO IDENTIFICATION OR THE MANUFACTURER'S OWN CODE IDENTIFICATION ONLY IN THE COLD SECTION OF THE ENGINE.
CAUTION : DO NOT USE PARTS WITH THE SAME MATERIAL CODE TOGETHER WITH PHYSICALLY SIMILAR PARTS THAT HAVE ANOTHER MATERIAL CODE.
CAUTION : USE ONLY NUTS AND BOLTS MADE OF SPECIAL HEAT RESISTANT ALLOYS IN THE HOT SECTION OF THE ENGINE; DO NOT USE HOT SECTION PARTS IN THE COLD SECTION OF THE ENGINE. DO NOT USE COLD SECTION PARTS IN THE HOT SECTION OF THE ENGINE.
CAUTION : DO NOT USE CADMIUM PLATED PARTS IN THE HOT SECTION OF THE ENGINE. CADMIUM PLATED PARTS MUST NOT TOUCH TITANIUM PARTS.
CAUTION : IF PARTS WITH CORRECT CODES ARE SERVICEABLE, INSTALL THEM IN THEIR ORIGINAL LOCATION DURING ASSEMBLY OF THE ENGINE OR ITS COMPONENTS. DO NOT ASSEMBLE A "C"-CODED PART IN AN "H"-CODED PART LOCATION; DO NOT ASSEMBLE AN "H"-CODED PART IN A "C"-CODED PART LOCATION.
CAUTION : DO NOT PUT PARTS FROM ONE ENGINE TOGETHER WITH THOSE FROM ANOTHER DURING DISASSEMBLY AND CLEANING.
(1)The letter code (Prefix)
NOTE : The letter "E" in the material code system is used to show that a part is a standard AN, MS, or AS part with a six-digit part number. The letter "E" is not used in the material code system for parts that are made by Pratt & Whitney.
(a)"EC" or "C" = Corrosion resistant steels
(b)"EH" or "H" = Heat resistant alloys for hot section parts
(c)"ET" or "T" = Titanium alloys
(d)"E" or "S" = Common temperature range alloys
NOTE : The prefix "E" is superseded by the prefix "S" in common temperature range material codes.

(2)Number code (Suffix)
(a)A one- or two-digit number follows the stamped or embossed letter code. Explanations of two example material codes, listed in Table 201 are as follows.
1 EC1 = Standard AN, MS, or AS engine parts made of AMS 5640 corrosion resistant steel.
2 H17 = Pratt & Whitney engine parts made of AMS 5649 heat resistant material.
(3)Location of bolt and nut code identification
(a)Bolt code identification will usually be found on the top of the bolt head (Ref. Fig. 223).
(b)Nut code identification will usually be found on one side of the hex (Ref. Fig. 223).
(4)New code identifications
(a)These new code identifications have the prefix "B" or "P" before the material code number. This is a temporary P&W code. Later, an "S", "C", "H" or "T" number will replace the temporary number (for example, refer to C15, H21, and T1 in Table 201).

D. Common Temperature Range, Corrosion Resistant, Heat Resistant, Titanium or Titanium Alloy, And Special Materials
(1)For lists of Common Temperature Range, Corrosion Resistant, Heat Resistant, Titanium or Titanium Alloy, And Special Materials Tables, refer to Table 201.

Material Code		
Standard Parts AN, MS, AS	Company Parts	Material Specification
E1	S1	AMS 6282, AMS 6320, AMS 6357, AMS 6535
E2	S2	AMS 7225
E3	S3	AMS 4121, AMS 4135, AMS 4153
E4	S4	AMS 5061
E5	S5	AMS 5045
E6	S6	AMS 6357 (Now E1/S1)
E7	S7	AMS 6280, AMS 6281, AMS 6355, AMS 6530, AMS 6550
E8	S8	AMS 6327 (Now E11/S11)
E9	S9	AMS 5024
E10	S10	AMS 5040
E11	S11	AMS 6322, AMS 6323, AMS 6325, AMS 6327, AMS 6358
E12	S12	AMS 4037, AMS 4120, AMS 4152
E13	S13	AMS 4045, AMS 4122, AMS 4139, AMS 4154
E14	S14	AMS 4152 (Now E12/S12)
E15	S15	AMS 4153 (Now E3/S3)
E16	S16	AMS 4154 (Now E13/S13)
E17	S17	AMS 5060
E18	S18	AMS 5062
E19	S19	AMS 5120
E20	S20	AMS 5121

Material Code		
Standard Parts AN, MS, AS	Company Parts	Material Specification
E21	S21	AMS 6324
E22	S22	AMS 6328
E23	S23	AMS 6350, AMS 6370, AMS 6371
E24	S24	AMS 6352 (Non-current), AMS 6365, AMS 6372
E25	S25	---
E26	S26	AMS 6355 (Now E7/S7)
E27	S27	AMS 6358 (Now E11/S11)
E28	S28	AMS 6323 and AMS 6371 (Now E23/S23)
E29	S29	---
E30	S30	AMS 6381, AMS 6382
E31	S31	AMS 6412, AMS 6413
E32	S32	AMS 6440, AMS 6441
E33	S33	AMS 4500
E34	S34	AMS 6359, AMS 6415
E35	S35	---
E36	S36	AMS 6300 (Non-current)
E37	S37	AMS 6304, (Was PWA 722, P5), AMS 7454, AMS 7455, AMS 7458
E38	S38	AMS 6418
E39	S39	AMS 6485
E40	S40	AMS 4003
E41	S41	AMS 4150
E42	S42	AMS 4352
		Corrosion Resistant Material
EC1	C1	AMS 5640
EC2	C2	AMS 5628
EC3	C3	AMS 5515, AMS 5516, AMS 5517, AMS 5518, AMS 5519, AMS 5636 (Was EC5/C5), AMS 5637, AMS 7472
EC4	C4	AMS 7228
EC5	C5	AMS 5636 (Now EC3/C3)
EC6	C6	AMS 5354, AMS 5508, AMS 5616, AMS 7470
EC7	C7	AMS 5610
EC8	C8	AMS 5504 (Was EC11/C11), AMS 5612, AMS 5613
EC9	C9	AMS 5624
EC10	C10	AMS 5513, AMS 5560, AMS 5565, AMS 5566, AMS 5639
EC11	C11	AMS 5504 (Now EC8/C8)
EC12	C12	AMS 5738
EC13	C13	AMS 5630
EC14	C14	AMS 5643
EC15	C15	AMS 5625 (Was P10)
EC16	C16	AMS 5506, AMS 5620 (Was P3), AMS 5621
EC17	C17	AMS 5644 (Inactive for New Design)
EC18	C18	AMS 5743
		Heat Resistant Materials
EH1	H1	AMS 7229

Material Code		
Standard Parts AN, MS, AS	Company Parts	Material Specification
EH2	H2	AMS 7232
EH3	H3	AMS 5526, AMS 5527, AMS 5721, and AMS 7476 (All 3 Inactive for New Design)
EH4	H4	AMS 5642
EH5	H5	AMS 5512, AMS 5571, AMS 5646
EH6	H6	AMS 5733 (Inactive for New Design)(Was PWA 746)
EH7	H7	AMS 5510, AMS 5557, AMS 5559, AMS 5570, AMS 5576, AMS 5645
EH8	H8	AMS 5524, AMS 5648
EH9	H9	AMS 5540, AMS 5580, AMS 5665
EH10	H10	AMS 5667 (Now EH14/H14)
EH11	H11	AMS 5521, AMS 5572, AMS 5651
EH12	H12	AMS 5522 (Inactive for New Design), AMS 5652
EH13	H13	(Now EH3/H3)
EH14	H14	AMS 5542, AMS 5667 (Was EH10/H10), AMS 5668
EH15	H15	CHROMEL
EH16	H16	ALUMEL
EH17	H17	AMS 5649
EH18	H18	AMS 5532, AMS 5768
EH19*	H19*	AMS 5525, AMS 5731, AMS 5732, AMS 5734, AMS 5736, AMS 5737, AMS 7481
EH20	H20	AMS 5511, AMS 5647
EH21	H21	AMS 5754 (Was P19)
EH22	H22	AMS 5530, AMS 5750 (Inactive for New Design)
EH23	H23	AMS 5545, AMS 5712, AMS 5713, AMS 7469
EH24	H24	AMS 5551, AMS 5756, and AMS 5757 (All 3 Inactive for New Design)
EH25	H25	AMS 5660, PWA 1003 (Was PWA 1002, P11)
EH26	H26	AMS 5706, AMS 5708 (Was PWA 90), AMS 5709 (Was P15), AMS 7471, PWA 686, PWA 687 (Was CF236, P18), AMS 5707 (Was PWA 1004)
EH27	H27	AMS 5759
EH28	H28	AMS 5662, PWA 1009
EH29	H29	AMS 5666 (Was P28)

*or Knurl (A knurl on the washer face diameter is sometimes used on double hex castellated nuts for material identification instead of the code).

Heat Resistant Titanium or Titanium Alloy Materials

ET1	T1	AMS 4921 (Was P8)
ET2	T2	AMS 4923
ET3	T3	AMS 4925
ET4	T4	AMS 4927
ET5	T5	AMS 4928 (Was PWA 682, P12), AMS 4967, AMS 7461
ET6	T6	AMS 4929

Special Materials

Material Code		
Standard Parts AN, MS, AS	Company Parts	Material Specification
	B7	ASTM A 193 Grade B7
	B16	ASTM A 193 Grade B16
	B660	ASTM A 453 Grade B660
	P3	AMS 5620 (Now EC16/C16)
	P5	PWA 722 (Now AMS 6304, E37/S37)
	P8	AMS 4921 (Now ET1/T1)
	P9	AMS 6302 (Inactive)
	P10	AMS 5625 (Now EC15/C15)
	P11	PWA 1002 (Now PWA 1003, EH25/H25)
	P12	PWA 682 (Now AMS 4928, ET5/T5)
	P15	AMS 5709 (Now EH26/H26)
	P18	CF236 (Now EH26/H26)
	P19	AMS 5754 (Now EH21/H21)
	P20	PWA 1202
	P21	PWA 1010
	P23	AMS 7477
	P24	AMS 7461
	P25	PWA 91
	P26	PWA 1006*, PWA 1008*, PWA 1013
	P27	AMS 7236
	P28	AMS 5666 (Now EH29/H29)
	P29	PWA 92, AMS 5828
	P30	AMS 5758
		*Canceled Specification

Table 201 Material Codes - Common Temperature Range Materials

E. Stainless Steel Bolts With Reduced Pitch Diameters

(1)At engine manufacture, it is customary to provide bolts with reduced pitch diameter for use in hot sections of engines. This will minimize possibility of bolt and nut seizure. This is standard practice for locations where parts are subjected to temperatures in excess of 500°F (260°C).

R 20.Marking Parts (Temporary and Permanent)

A. Equipment and Materials

ITEM	DESIGNATION
(1)Material No.P05-018	Special Materials (Ref. 70-00-00)
(2)Material No.P05-022	Special Materials (Ref. 70-00-00)
(3)Material No.P05-026	Special Materials (Ref. 70-00-00)
(4)Material No.P05-040	Special Materials (Ref. 70-00-00)
(5)Material No.P05-049	Special Materials (Ref. 70-00-00)
(6)Material No.P05-232	Special Materials (Ref. 70-00-00)

ITEM	DESIGNATION
(7)Material No.P05-366	Special Materials (Ref. 70-00-00)
(8)Material No.P05-408	Special Materials (Ref. 70-00-00)
(9)Material No.P05-409	Special Materials (Ref. 70-00-00)
(10)Material No.P05-410	Special Materials (Ref. 70-00-00)
(11)Material No.P05-411	Special Materials (Ref. 70-00-00)
(12)Material No.P05-413	Special Materials (Ref. 70-00-00)
(13)Material No.P05-414	Special Materials (Ref. 70-00-00)
(14)Material No.P05-415	Special Materials (Ref. 70-00-00)
(15)Material No.P05-416	Special Materials (Ref. 70-00-00)
(16)Material No.P05-417	Special Materials (Ref. 70-00-00)
(17)Material No.P05-418	Special Materials (Ref. 70-00-00)
(18)Material No.P05-419	Special Materials (Ref. 70-00-00)
(19)Material No.P05-423	Special Materials (Ref. 70-00-00)
(20)Material No.P05-441	Special Materials (Ref. 70-00-00)
(21)Material No.P05-465	Special Materials (Ref. 70-00-00)
(22)Material No.P05-470	Special Materials (Ref. 70-00-00)
(23)Material No.P05-471	Special Materials (Ref. 70-00-00)
(24)Material No.P05-472	Special Materials (Ref. 70-00-00)
(25)Material No.P05-477	Special Materials (Ref. 70-00-00)
(26)Material No.P07-001	Lacquers (Ref. 70-00-00)

B. Procedure - General

CAUTION : THE MARK MUST NOT CHANGE THE CONDITION OR THE OPERATION OF THE PART. ONLY THE APPLICABLE PRATT & WHITNEY PROCEDURE IS TO BE USED TO MAKE MARKS.

(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2)Marks made on engine parts and assemblies must be easily read and must not be easily removed.

(a)Characters must be easily and accurately read usually with no aid to the eye.

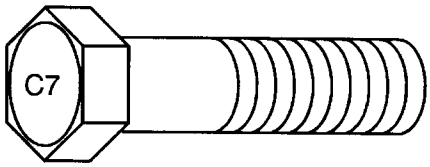
(b)Where there are unusual area or surface limits, a maximum of 3.5X magnification is permitted to get the necessary readability.

(c)The location of a mark must be as specified in the Service Bulletin or AMM maintenance task.

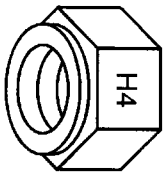
NOTE : Be sure to apply the mark only on a surface that will not move relative to a surface that touches it after you assemble the parts.

(3)Except where specified differently, reidentification of parts, reapplication and/or relocation of marks on a part must be done adjacent to, or in a location almost the same as that of the initial marking. Where reidentification or corrective marks are specified, removal of all or part of the old marking can be necessary. In these cases, use an approved marking method to draw a wavy line, loop, flat oval, or X's through the character(s) or symbol(s) to be removed.

(4)All the characters in a mark, unless specified differently, must be 0.060 to 0.160 in. (1.5 to 4.1 mm) high. In special cases, when the mark is a function of the size or configuration of part, characters not less



TYPICAL BOLT CODE IDENTIFICATION
LOCATION



TYPICAL NUT CODE IDENTIFICATION
LOCATION

BM5 70 00 00 2 KUM0 02

G-00511 (0802)
PW V

Bolt and Nut Code Identification
Figure 223

than 0.016 in. (0.406 mm) nor more than 0.500 in. (12.700 mm) in height are permitted.

(5)If the surface specified for a mark will get a surface treatment coating (for example, paint), you must apply the mark before you apply the coating. Use an approved permanent marking method that will show through the final surface treatment.

(a)If none of the specified marking methods will show through the coating, then it is permitted to use the applicable step to make the mark after you apply the coating:

1 On external surfaces, apply the mark with ink and a stamp, and then apply a full layer of Lacquer (Material No.P07-001) on the mark.

2 On internal surfaces, apply the mark by the applicable step:

- If permitted by the repair instructions, apply the mark by the vibration peen method.
- Apply the mark with ink and a stamp, and then apply a full layer of transparent Varnish (Material No.P05-040) on the mark.

CAUTION : **DO NOT USE VIBRATION PEENING, ETCHING, OR MECHANICAL METHODS TO APPLY MARKS TO THE MATING SURFACES OF PARTS UNLESS THESE METHODS ARE SPECIFIED IN THE APPLICABLE MANUAL SECTION.**

(6)In electric arc scribing (for example, hand arc scribing), the characters are made by the action of an electric arc between a surface and an electrode (scriber). Electric arc scribing is not a satisfactory marking method to use for jet engine parts and must not be used.

(7)In acid etching, the characters are made by the action of an acid on the surface of the part. Acid etching is not recommended because it can possibly cause corrosion.

(8)Soapstone must not be used to make a mark on engine parts.

(9)Wherever the vibration peen method is approved, identify offset holes in mating parts with a vibration peened "X" mark adjacent to the offset hole as long as the condition or operation of the part is not changed.

C. Permanent Marking Methods - General Information

(1)Permanent methods of marking are those in which marking is legible during the normal service life of the part.

(2)Permanent markings must not extend onto any radius, chamfer, sharp edge, bead, or fillet adjacent to the specified marking surface.

D. Applied Permanent Marking Methods

(1)Metal Stamping

(a)Characters are produced by forcible displacement of material.

1 Hammer - characters are made one at a time or in groups by a force applied mechanically or manually.

2 Press - characters are produced individually or in groups by a force applied as you steadily increase the controlled pressure.

3 Roll - characters are made as the part or the tool or both the part and the tool turn when they touch each other under a controlled force.

(b)Stamps used for marking must make fillets and radii at all intersecting surfaces of the characters.

(c)Parts marked by this method must have the marking area sufficiently back-supported to prevent dangerous stresses.

(d)This method is not permitted if the hardness of the part at the time of marking is higher than Rockell C45 or equivalent.
(e)If the metal is raised more than 0.001 inch (0.025 mm) by this method of marking, it is necessary to carefully remove it.
NOTE : It is necessary to remove all raised metal around the characters on the surfaces of bearings that touch.

(2)Vibration Peen Method
(a)Characters are made by vibrations from a radius-tipped, conical tool.
1 Manual - tool is manually guided and has one tip.
2 Mechanical - tool is mechanically guided and has one or more tips that can make one or more full characters at the same time.
(b)This method is not usually permitted if the hardness of the part at the time of marking is higher than Rockwell C45 or equivalent. It can be used on parts harder than Rockwell C45 when specifically permitted.
NOTE : The vibration peen method can be an alternative to use on those parts that had drag impression or roll marking.

(3)Engraving
(a)Characters are made by a manually or mechanically guided cutter or grinder that turns.

(4)Brand
(a)Characters are made by burning or displacing non-metallic material with a hot tool.

(5)Drag Impression
(a)Characters are made when material is moved by force by a radius-tipped conical tool, whic is drawn (dragged) across the surface of the part. This tool is mechanically guided and turns freely.

(6)Blast
(a)Characters are made when an abrasive material hits the characters in the stencil area.

E. Marking Depth
(1)The depth of the marks must be at these maximum limits, unless specified differently :

MARK	LIMITS
Metal Stamp, Hammer	0.010 inch (0.254 mm)
Metal Stamp, Press and Roll	0.006 inch (0.152 mm)
Vibration Peen, Manual and Mechanical	0.006 inch (0.152 mm)
Engrave, Manual and Mechanical	0.003 inch (0.076 mm)
Brand	0.010 inch (0.254 mm)
Drag Impression	0.003 inch (0.076 mm)
Blast	0.005 inch (0.013 mm)

F. Permanent Marking Materials
(1)Inks
(a)Black Stamping Ink (Material No.P05-411) (For Marking on Non-porous Surfaces with a Rubber Stamp).
(b)White Stamping Ink (Material No.P05-412) (For Marking on Non-porous Surfaces with a Rubber Stamp).
(c)Black Permanent Marking Ink (Material No.P05-413).
(2)Markers
(a)Marker (Felt Tip) (Material No.P05-408).
(b)Marker (Metal Tip) (Material No.P05-409).
(c)Yellow Marker (Felt Tip) (Material No.P05-410).
(d)Marker, Extra Fine Point (Black) (Material No.P05-414).
(3)Pens
(a)Trace Element Certified (TEC) Permanent Marking Pen (PMC 4556) (Material No.P05-415).

G. Temporary Marking Methods - General Information
CAUTION : USE ONLY THE APPROVED MATERIALS SPECIFIED IN THE PMC'S FOR MARKING.
CAUTION : DO NOT USE LEAD AND/OR METALLIC PENCILS OR A TEMPORARY MARKING METHOD THAT CAN CAUSE DANGEROUS REMAINING CARBON, ZINC, COPPER, LEAD, OR SIMILAR MATERIAL TO OCCUR ON A PART. THIS REMAINING MATERIAL CAN CAUSE A REDUCTION IN FATIGUE STRENGTH AS A RESULT OF CARBURIZATION OR INTERGRANULAR ATTACK WHEN HEAT OF HIGH INTENSITY IS APPLIED TO THE PART. IF A MARKING MATERIAL THAT IS NOT APPROVED IS USED, THE MARK MUST BE FULLY REMOVED BY THE SPOP 208 SOLVENT WIPE PROCEDURE. REFER TO AMM 70-00-00, P. BLOCK 201.
(1)Temporary methods of marking are those in which the marks will correctly identify a part during the usual handling, inspection, and storage of items before final assembly and use.
(2)When you use a marking pencil, do not apply marks to the surfaces of carbon seal plates or to mating surfaces of finished machined parts. Marking material remaining on these parts could cause incorrect results during dimensional inspection and assembly.
(3)These marking materials must be removed:
(a)Chalk
1 After inspection is completed, remove chalk from parts. Use Degrease Engine Parts By Solvent Wipe (SPOP 208). Refer to AMM 70-00-00, P. Block 201.
(b)Dye, Layout and Identification
1 Remove layout and identification dye from parts before you assemble the parts in the engine. Use Degrease Engine Parts By Solvent Wipe (SPOP 208). Refer to AMM 70-00-00, P. Block 201.

H. Applied Temporary Marking Methods
(1)In Marking
(a)Characters are made by ink application that does not change the surface as mechanical methods do.
NOTE : Usually, ink stamping, when used as a temporary marking method, can be applied to a surface which, after assembly, does not move in relation to a surface that it touches (that is, a

contact surface).

R J. Temporary Marking Materials

NOTE : The marks made by the subsequent materials do not have to be removed unless specified below. These materials are approved to use on steel, stainless steel, nickel-base alloys, cobalt-base alloys, aluminum, titanium, and titanium alloys unless specified differently below.

(1)This material is used to highlight stamped or vibration peened part numbers during inspection and is approved to use on all gas turbine engine alloys if you remove the material after the inspection is completed:

(a)Chalk

1 White Chalk (Low Dust) (Material No.P05-416).

(2)These materials are approved to use on steel, stainless steel, cobalt-base alloys, aluminum, magnesium, titanium, titanium alloys, and on nickel-base alloys other than nickel superalloys (for example, PWA 1422 or PWA 1480) unless specified differently below:

(a)Crayons

1 Metal Marking Crayon (Soft) (Material No.P05-232).

(b)Dyes, Layout and Identification

1 Dye - Layout and Identification, LOX Compatible (Purple) (Material No.P05-022).

2 Dye, Layout and Identification (Material No.P05-366).

3 Dye, Layout and Identification (Blue) (Material No.P05-418).

4 Dye, Layout and Identification (Red) (Material No.P05-419).

(c)Inks (Applied by a brush or stamp)

1 Black Metal Marking Ink (Material No.P05-026).

NOTE : Black Metal Marking Ink (Material No.P05-026) is approved to use on aluminide coated or PWA 286 coated or ceramic coated parts and on nickel superalloys (for example, PWA 1422 and PWA 1480).

2 White Metal Marking Ink (Material No.P05-049).

NOTE : White Metal Marking Ink (Material No.P05-049) is approved to use on aluminide coated or PWA 286 coated parts and on nickel superalloys (for example, PWA 1422 and PWA 1480).

3 Black Stamping Ink (For Marking on Non-porous Surfaces with a Rubber Stamp) (Material No.P05-411).

NOTE : Black Stamping Ink (Material No.P05-411) is also approved to use on PWA 73, overlay, aluminide, and ceramic coated parts.

4 Black Marking Ink (Material No.P05-413).

5 White Metal Marking Ink (Material No.P05-441).

NOTE : White Metal Marking Ink (Material No.P05-441) is approved to use on aluminide coated or PWA 286 coated parts.

6 Green Metal Marking Ink (Material No.P05-465).

NOTE : Green Metal Marking Ink (Material No.P05-465) is also approved to use on nickel superalloys (for example, PWA 1422 and PWA 1480).

7 White Metal Marking Ink (Material No.P05-466).

NOTE : White Metal Marking Ink (Material No.P05-466) is approved to use on aluminide coated or PWA 286 coated parts and on nickel

superalloys (for example, PWA 1422 and PWA 1480).

(d)Markers

CAUTION : FELT TIP MARKER (MATERIAL No. P05-423) IS DIFFICULT TO REMOVE FROM ALUMINUM ALLOYS. THUS, DO NOT USE THIS MARKER FOR TEMPORARY INSPECTION OR IN-PROCESS MARKING ON ANODIZED OR FINISHED SURFACES OF ALUMINUM ALLOY GAS TURBINE ENGINE PARTS.

1 Felt Tip Marker (Material No.P05-423).

NOTE : Felt Tip Marker (Material No.P05-423) is also approved for other applications (see Notes below). This does not always include all markers available for a given suffix.

NOTE : The Marks-A-Lot markers for PMC 4050-1 (black/chisel point) and PMC 4050-4 (black/fine point) are also approved to use on nickel superalloys and on ceramic coatings.

NOTE : The Sharpie markers for PMC 4050-4 (black/fine point) and all markers for PMC 4050-17 (black/bold fine point), PMC 4050-7 (red/fine point), PMC 4050-12 (red/extra fine point), PMC 4050-15 (red/ultra fine point), and PMC 4050-18 (red/bold fine point) are also approved to use on ceramic and overlay and aluminide coatings.

NOTE : All PMC 4050-6 (blue/fine point) and all PMC 4050-16 (blue/ultra fine point) markers are approved to use on aluminide coatings.

NOTE : Felt Tip Marker (Material No. P05-423) is not approved to use on Alloy C titanium alloy.

2 Marker, Extra Fine Point (Black) (Material No.P05-414).

3 White Marker (Felt Tip) (Material No.P05-408).

4 Black Marker (Metal Tip) (Material No.P05-409).

5 Yellow Marker (Felt Tip) (Material No.P05-410).

6 Marker, High Purity (Blue) (Material No.P05-470).

7 Marker, High Temperature (Blue) (Material No.P05-471).

8 Marker, High Purity, Black, Trace Element Certified (Material No.P05-472).

9 Marker, High Temperature (Blue) (Material No.P05-477).

(e)Pencils

1 Metal Marking Pencil (Hard) (Material No.P05-018).

(f)Pens

1 Black, Trace Element Certified (TEC) Marking Pen (PMC 4556) (Material No.P05-415).

2 Marking Pen (White or Yellow Paint) (Material No.P05-417).

R 21.Guidelines for the Reuse of Damaged Engines and Engine Parts

A. Equipment and Materials

ITEM	DESIGNATION
(1)None	

B. General

(1)The subsequent guidelines are provided to assist owners, operators, and

maintenance facilities in the disposition of engines and engine parts involved in Abnormal Operational Circumstances.

(a)Abnormal Operational Circumstances are defined as accidents or other events which fall outside of the operating envelope for the engine, aircraft and/or the engine/aircraft combination as initially certified and where inspection, refurbishment, and repair data are not addressed by FAA-approved publications (such as, engine manuals, service bulletins).

(b)The data contained in these FAA-approved publications normally address engine and engine parts which experience wear, deterioration, or damage through exposure to the usual day-to-day operating environment.

(2)The guidelines apply to the engine-associated abnormal operational circumstances that follow :

NOTE : The guidelines refer to the abnormal operational circumstances of an engine or aircraft. It is important that the damage be identified as engine-caused or related to abnormal operation of the aircraft so correct application of the inspection guidelines can be made.

NOTE : The inspection guidelines are written for evaluation of suspected damage of an engine-induced abnormal operational cicumstance (such as, a major rotor failure). These guidelines take into account the loads generated by the engine.

NOTE : These inspection guidelines, however, may not sufficiently cover engines or parts that have been subjected to excessive external loads brought on by an abnormal operation of the aircraft (such as, an aircraft landing accident where the engines are impacted). Evidence of excessive external loading generated by an aircraft abnormal operation will be found where external loads have been applied to major structural case/mounts or rotating elements that either result in the permanent distortion to the major load-carrying elements and/or the separation of a running engine from its attachments.

(a)Abnormal Operational Circumstances - Engines And Engine Parts Unacceptable for Continued Aircraft Use.

(b)Abnormal Operational Circumstances - Engines And Engine Parts Potentially Acceptable For Continued Aircraft Use.

(3)For Abnormal Operational Circumstances not addressed by these guidelines, Pratt & Whitney considers engines and engine parts unacceptable for continued aircraft use unless reviewed and approved on a case-by-case basis.

(4)The guidelines are based upon Pratt & Whitney's general experience in this area and therefore are to be used as general guidelines. In any particular incident, however, more complete information or inspection results may require alternate action. The engine or engine part owner should not rely upon the information in these guidelines without a thorough understanding of the damage to the engine or engine parts and its effect on engine operation. "It should be understood that the following are only guidelines and that any and all responsibility for returning any engine or engine part to service remains with the engine or part owner".

(5)The definitions that follow are for technical terms used in these

guidelines :

(a)Definitions from ATA World Airlines Technical Operations Glossary (WATOG) :

1 Accident : An occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight, until such time as all such persons have disembarked, in which :

a Any person suffers death or serious injury as a result of being in or upon the aircraft, or by direct contact with the aircraft or anything attached thereto; or

b The aircraft receives substantial damage; or

c Any damage is caused to the property of a third party.

2 Damage, accidental : Physical deterioration of an item caused by contact or impact with an object or influence which is not a part of the aircraft, or by incorrect manufacturing or maintenance practices.

(b)Non-WATOG definitions used in the Guidelines

1 Engine : Engines made by Pratt & Whitney Division of United Technologies Corporation.

2 Engine Parts : Parts sold by Pratt & Whitney and delivered as original equipment in an engine installed on an airplane or installed in a spare engine or sold by Pratt & Whitney as new spare parts for an engine.

NOTE : Engine parts include vendor-supplied accessories and components which are approved by Pratt & Whitney.

3 Abnormal Operational Circumstances : Accidents or other events which occur outside the operational envelope for the engine or the airplane or the engine and airplane combination as it was initially certified, and where inspection, refurbishment, and repair data are not in FAA-approved publications (such as, Engine Manuals, Service Bulletins, etc.).

C. Abnormal Operational Circumstances - Engines and Engine Parts Unacceptable For Continued Aircraft Use

(1)Pratt & Whitney considers engines and engine parts involved in the subsequent types of circumstances unacceptable for continued aircraft use:

NOTE : It is recognized that an aircraft could be damaged beyond economical repair without any resulting engine involvement. In such cases, the engine and engine parts can be considered "not involved" in an abnormal operational circumstance.

(a)Engines and engine parts installed in an aircraft totally destroyed by fire.

(b)Engines and engine parts totally engulfed in fire to the extent that outer cases have been heat discolored and/or distorted or the engine is otherwise damaged by heat over a significant area of the engine, either external or internal.

(c)Engine and engine parts installed in an aircraft totally destroyed by impact damage.

(d)Evidence of excessive external loads generated by abnormal aircraft operation.

(e)Engine or engine parts subjected to partial or full immersion in salt water.

D. Abnormal Operational Circumstances - Engines and Engine Parts Potentially Acceptable For Continued Aircraft Use

(1)Accidents

(a)Pratt & Whitney considers engines and engine parts involved in the types of accidents that follow potentially acceptable for continued aircraft use :

1 Type 1 : Engines and engine parts involved in an accident in which the nacelles and engines remain undamaged.

2 Type 2 : Engines or engine parts involved in a fire wherein a portion of the aircraft was destroyed but the engines were not subjected to fire damage.

3 Type 3 : Engines which will not rotate freely but do not exhibit evidence of being subjected to excessive external loads.

4 Type 4 : Engines subjected to partial of full immersion in fresh water for a brief period of time.

(b)Acceptance criteria for engines or engine parts

1 Engines and engine parts involved in Type 1 and Type 2 accidents can be considered "not involved" in an abnormal operational circumstance.

2 Engines and engine parts involved in Type 3 and Type 4 accidents should be 100 percent disassembled and examined. Refer to the following paragraph, Accident Engine, General Inspection Guidelines for general guidelines to be used in conjunction with FAA-approved publications.

NOTE : Owners, unable to do the necessary tests or in doubt whether to accept or reject a part, should contact Pratt & Whitney for assistance.

E. Serious Operational Events

(1)Pratt & Whitney considers engines and engine parts involved in the subsequent types of serious operational events as potentially acceptable for continued aircraft use if the criteria defined are observed.

(a)Single fan blade fractures outboard of part span shroud

NOTE : A single fan blade fracture that occurs outboard of the part span shroud can cause varying degrees of engine damage. Refer to specific AMM maintenance and inspection tasks for bird or object ingestion inspections and damage limits. In general, the inspection guidelines that follow can be applied to events where a single blade has fractured outboard of the part span shroud.

1 Check for evidence of core ingestion.

2 Examine the fan blade shrouds for evidence of shingling.

3 Examine the fan rubstrip for damage beyond limits.

4 Check the fan exit guide vanes for damage.

5 Examine the engine externals for broken or cracked brackets and case flanges.

6 Do a borescope inspection of the compressor gaspath for excessive blade tip rub and blade-to-vane clash.

(b)Single blade fracture inboard of the part span shroud or the multiple fan blade fractures

NOTE : A single fan blade structure inboard of the part span shroud or multiple fractures generate a significant amount of rotor vibration. More extensive inspections with disassembly of the N1 rotor modules is necessary as a minimum. Further teardown is necessary as inspection findings dictate.

1 Scrap N1 rotor mainshaft bearings and N2 rotor mainshaft roller bearings.
2 Examine the N1 rotor shaft (front compressor turbine driveshaft) for rub with the N2 rotor shaft.
3 Examine cases, bearing supports, and fan ducts for distortion and cracks particularly at engine mount locations.
4 Examine the main oil filter and chip collectors.
5 Examine the gearbox mounts.
6 Examine all external components, tubing and wiring for cracks and chafing.
7 Do a visual and borescope inspection of modules not disassembled for object damage, excessive blade tip rub, or blade-to-vane clash.

(c)Serious engine damage within modules or build groups

1 Major rotating part fractures
a There is considerable variability in resultant damage from compressor and turbine blade fractures. As a minimum, the affected module requires teardown inspection. A thorough visual and borescope inspection of those modules not disassembled should be done. The modules should be disassembled if gaspath damage is noted or metal spatter is observed on hot section parts. If the blade fracture is determined to have resulted from object damage, then forward modules should be disassembled to access upstream damage and determine source of damaging object.
b Disk or spacer (rotating airseal) fractures usually result in significant damage. Moreover, the engine experiences high vibration as a result. In such events, a total engine teardown should be done. Special attention should be directed at shafts and cases for cracks and distortion.

2 Major stationary part fractures
a The most significant stationary part fractures are usually associated with compressor stators. In past experience, HPC stator fractures have caused significant resultant damage. In most instances, serious overtemperature of hot section parts has occurred. A total teardown and inspection of the affected module is necessary. Examine disks for cracks particularly in the blade slot/rim areas. Examine blades for cracks and damage. If metal spatter or evidence of overtemperature is observed on downstream module parts, disassemble and examine downstream modules. Examine all mainshaft bearings.

(d)Mainshaft bearing and gearbox distress

1 An engine which experiences a mainshaft bearing fracture must be disassembled sufficiently to examine the affected compartment area (this includes journal surfaces, compartment seals and scavenge pump). The gearbox, which includes the angle gearbox, should also be disassembled and examined since it is an integral part of the oil system where bearing debris can collect. If the affected compartment

is drained through the gearbox drive (towershaft) system, disassemble and examine the drive system components.

2 For an engine which experiences shaft or bearing fracture in the gearbox drive (towershaft) system, disassemble and examine the gearbox drive system and the gearbox (this includes the angle gearbox).

3 A teardown and inspection of the gearbox and parts therein is all that is necessary if the distress is fully contained within the gearbox. However, if there is evidence of bearing, gear or spline distress, do a progressive inspection through the gearbox drive (towershaft) system until assured of no further distress.

(e)Engines which experience sudden stoppage

1 An engine experiences sudden stoppage usually as a result of significant ingestion or distress. In every instance of sudden stoppage, a total engine teardown and 100 percent engine part inspection should be done. During teardown, special attention should be paid to that which follows :

a Examine all cases and bearing supports for distortion.

b Examine rotor shafts and hubs for twist; and, splines for wear and distortion.

c Examine mainshaft bearings and replace as necessary. Sudden stoppage interrupts oil flow which may cause heat soak to damage bearings. Scrap bearings that show heat discoloration.

(f)Engines involved in an operational fire (burnthrough, bearing compartment, etc.)

1 An engine involved in an operational fire should be fully torn down with subsequent inspection of all engine parts. Refer to the subsequent paragraph, Accident Engine, General Inspection Guidelines, for disposition of engine parts with particular attention to those that show heat discoloration.

2 If extinguishing agents have been applied to the engine, gaspath cleaning is to be done by the applicable AMM maintenance task, as quickly as practical, to prevent corrosion. Refer to Cleaning Requirements After Chemical Contact With Fire Extinguishing Agents, Hydraulic Fluid, Oil, or Fuel (SPOP 425) (Ref. 70-00-00, P. Block 201).

F. "Impacted" And "Dropped" Engines

NOTE : Refer to the previous paragraph, Abnormal Operational Circumstances - Engines And Engine Parts Unacceptable For Continued Aircraft Use, for engines impacted and/or separated from aircraft mounts during a landing accident or incident.

(1)The damage or circumstances which can result in an "Impacted" engine include impact with the ground, a collision with a service vehicle, etc. An engine dragged on the ground or against another object is considered an impacted engine. "Dropped" engines refer to engines which are dropped entirely or on either end. Inspection requirements for impacted and dropped engines are similar and progressive in scope; that is, proceeding with further teardown is dependent on the degree of damage found at each level of inspection.

(a)For an engine mounted on an aircraft where pylon or nacelle damage has

occurred, examine the engine mount flanges, cases, external components and plumbing, and gearbox housing and mounts. If the impact was such that debris may have entered the engine inlet, examine the engine for ingestion, and check the bleed system filters and valves for debris.

1 If no damage is noted, no further action is necessary.

2 If damage is noted to external components and plumbing, replace damaged items.

3 If damage is noted to mount flanges, gearbox or gearbox mounts or cases, remove the engine and examine the front and rear N1 rotor mainshaft bearings for damage or brinelling. Borescope the engine and check the rotors for freedom of movement and listen for unusual rubbing sounds.

a If damage is noted on N1 mainshaft bearings, remove and examine all mainshaft bearings.

4 Monitor chip collectors and oil filter on a more frequent basis during the initial return of the engine to service.

(b)For dropped engines do as follows :

1 Remove front and rear N1 rotor mainshaft bearings and examine for damage or brinelling.

a If bearing damage is noted, remove and examine all mainshaft bearings.

2 Do a visual and borescope inspection. Check for freedom of N1 and N2 rotor movement and listen for unusual rubbing sounds.

3 Monitor chip collectors and oil filter on a more frequent basis during initial return of the engine to service.

G. Tailpipe Fires

(1)In general, tailpipe fires of short duration and extinguished by "motoring" the engine will probably have little harmful effect on the exhaust area engine parts.

(a)Examine the exhaust area for signs of scorching. Any parts that show scorching (this includes the fan duct acoustic liners, if so equipped) should be replaced.

(2)Engines which experience a more persistent tailpipe fire or when starting overtemperature limits are exceeded during a tailpipe fire present a greater potential for thermal stress.

(a)Remove the engine and disassemble sufficiently to determine if hot section engine parts have experienced excessive temperature or if the turbine disks have been exposed to fire. The same part disposition applies as discussed in the subsequent paragraph Accident Engine, General Inspection Guidelines.

H. Accident Engine, General Inspection Guidelines

NOTE : Inspection is to be used in conjunction with existing FAA-approved data for engine parts (that is, data in publications such as Engine Manuals, Standard Practices Manuals, Component Maintenance Manuals).

(1)For the disassembly, cleaning, visual inspection, and general inspection of the engine gaspath, remove the engine and use the shop Engine Manuals, Standard Practices Manuals, Component Maintenance Manuals.

R 22.Potable Water Quality Specifications (For Use in Compressor Wash or

Detergent Cleaning Procedures On-Wing)

NOTE : Maintenance Manuals use potable water for rinsing after detergent washing.
NOTE : SPS 87 gaspath/compressor solution uses potable water in its make-up. Refer to 70-00-00, P. Block 201 for the make-up of this solution.

A. Equipment and Materials

ITEM	DESIGNATION
(1)None	

B. General - Potable Water Quality Specifications (Compressor Wash)
(1)The quality specifications for potable water suitable for engine gaspath cleaning are as follows :
(a)Water used for engine gaspath cleaning must agree with local quality specifications for potable water and with the quality specificications that follow.
NOTE : When the local quality specificiations for potable water and the quality specifications that follow do not agree, the quality specifications that follow are applicable.

PHYSICAL	PERMITTED LEVELS (Analysis at 75°F(24°C))
Ph	6.0 - 10.0
Total Dissolved Solids	500 mg/l maximum
Specific Resistance	1800 ohms-cm maximum
or	
Conductivity	550 microsiemens/cm maximum

INORGANIC	MILLIGRAMS/LITER
Chlorides	250 maximum
Fluoride	2.0 maximum

R 23.Preparation of Gaspath/Compressor Cleaner Solution (SPS 87)

A. Equipment and Materials

ITEM	DESIGNATION
(1)Material No.P11-021	Cleaning Agents (Ref. 70-00-00)

B. Procedure - General Instructions
(1)Always obey the procedures and limits in the applicable AMM maintenance tasks.

(2)Refer to Potable Water Quality Specifications for potable water specifications (Ref. 70-00-00, P. Block 201).
(3)Mix as specified in the applicable gaspath/compressor cleaning cart.
NOTE : SPMC 87-1 thru -3 and SPMC 87-8 are not available ; there are no replacements.
(a)SPMC 87-4, -6, -7, -10A, -11C, -12, -13, or -14 at 20 percent by volume with potable water
(b)SPMC 87-5, -9A, -10B, or -11B at 100 percent by volume
(c)SPMC 87-9B at 15 percent by volume with potable water
(d)SPMC 87-11A at 10 percent by volume with potable water.
(4)Use the solution at ambient temperature unless the manufacturer's instructions specify differently.

R 24.Preparation of Blue Dye Oil System Leak Check Solution (PS 197)

A. Equipment and Materials

ITEM	DESIGNATION
(1)Material No.P03-001	Oils (Ref. 70-00-00)
(2)Material No.P05-459	Special Materials (Ref. 70-00-00)

B. Procedure
(1)General instructions
(a)Always obey the procedures and limits in the applicable AMM maintenance tasks.
(2)Make-up of PS 197 blue dye solution

Materials	Make-Up	Operating Limits
Dye, Blue (Material No. P05-459)	6 - 7 milliliters	150 ± 40 ppm
Oil, Engine Lubricating (Material No. P03-001)	10 gallons (37.85 liters)	

(3)Preparation of PS 197 blue dye solution
(a)Add the specified amount of Engine Lubricating Oil (Material No.P03-001) to the mixing container.
NOTE : The selection of base oil (Approved PWA 521, Type II) will make it easier for the operator to see the blue color of the dyed oil. Pratt & Whitney experience finds that light color PWA 521, Type II base oils are more easily detected with the Blue Dye (Material No.P05-459).
(b)Add the specified amount of Blue Dye (Material No.P05-459).
NOTE : It is necessary to put Blue Dye (Material No.P05-459) through a five-micron or less membrane filter six weeks or less before you mix it with Engine Lubricating Oil (Material No.P03-001)

for PS 197.
(c)Stir to mix.
(4)Precautions
NOTE : This solution is organic.
(a)Do not permit the solution to touch the skin, eyes, nose, or throat.
(b)Do not take this solution internally.
(c)Be sure to wash fully after handling and before you drink or smoke.
(d)Keep this solution away from food.
(e)Do not breathe the dust, vapors, mists, or gases.
(f)Use this solution with sufficient ventilation.
(g)Keep this solution away from heat or flames ; toxic mixtures can occur.
(h)Be sure to wear the necessary safety equipment.
(j)Keep this solution away from oxidizers.

R 25.Cleaning the Exterior of the Engine (SPOP 1)

A. Reason For the Job
(1)This task gives the necessary instructions for the cleaning of the exterior of the engine.

B. Equipment and Materials

ITEM	DESIGNATION
FOR ASSEMBLED ENGINES : METHOD A	
SPRAY, STEAM, OR FOAM CLEANERS :	
(1)Material No.P11-031	Cleaning Agents (Ref. 70-00-00)
(2)Material No.P11-040	Cleaning Agents (Ref. 70-00-00)
(3)Material No.P11-044	Cleaning Agents (Ref. 70-00-00)
(4)Material No.P11-045	Cleaning Agents (Ref. 70-00-00)
(5)Material No.P11-071	Cleaning Agents (Ref. 70-00-00)
(6)Material No.P11-072	Cleaning Agents (Ref. 70-00-00)
(7)Material No.P11-073	Cleaning Agents (Ref. 70-00-00)
(8)Material No.P11-079	Cleaning Agents (Ref. 70-00-00)
(9)Material No.P11-080	Cleaning Agents (Ref. 70-00-00)
(10)Material No.P11-081	Cleaning Agents (Ref. 70-00-00)
(11)Material No.P11-082	Cleaning Agents (Ref. 70-00-00)
R (12)Material No.P11-083	Cleaning Agents (Ref. 70-00-00)
GEL CLEANERS :	
R (13)Material No.P11-047	Cleaning Agents (Ref. 70-00-00)
R (14)Material No.P11-048	Cleaning Agents (Ref. 70-00-00)
R (15)Material No.P11-069	Cleaning Agents (Ref. 70-00-00)
R (16)Material No.P11-070	Cleaning Agents (Ref. 70-00-00)
FOR ASSEMBLED ENGINES : METHOD B	
R (17)Material No.P05-421	Special Materials (Ref. 70-00-00)
R (18)Material No.P05-422	Special Materials (Ref. 70-00-00)
SPRAY OR WIPE CLEANERS :	
R (19)Material No.P11-049	Cleaning Agents (Ref. 70-00-00)
FOR DISASSEMBLED ENGINES	
(Refer to Method A or B above or use the subsequent consumable material)	
CLEANER APPLIED BY A BRUSH :	
R (20)Material No.P11-027	Cleaning Agents (Ref. 70-00-00)

C. Job Set-up
(1)General
WARNING : REFER TO THE MANUFACTURER'S MATERIAL SAFETY DATA SHEETS FOR CONSUMABLE MATERIAL'S INFORMATION SUCH AS: HAZARDOUS INGREDIENTS, PHYSICAL/CHEMICAL CHARACTERISTICS, FIRE, EXPLOSION, REACTIVITY, HEALTH HAZARD DATA, PRECAUTIONS FOR SAFE HANDLING, USE AND CONTROL MEASURES.
(a)This task gives the necessary instructions for the removal of oils, grease, hydraulic fluid, and loose soil from engine exterior surfaces (that is, the outer surfaces of the engine) or external parts, which decreases the time necessary to clean disassembled QEC (Quick Engine Change) parts. This procedure does not remove hard, baked-on carbon.
(2)Procedure to degrease the exterior of the engine by method A or method B
(a)Method A
1 Install covers on all openings into the engine (this includes the
R inlet, exhaust, all bleeds, open fuel lines, open oil lines, breather tubes, and open electrical connectors).
R 2 Clean by one of the subsequent procedures :
NOTE : Service experience shows that the gel-type cleaners are more effective that the spray, steam, and foam solutions on very dirty engines because the gel cleaners stay on the engine better than the spray, steam, and foam solutions, which drain off the engine during the soak time.
R - Mix one of these materials with water to make a cleaner solution
R at a concentration that is equal to or less than the maximum
R specified concentration, then apply this solution as a spray,
R steam, or foam :

Specification (Material No.)	Name	Maximum Concentration (Mixed with water)
P11-031	Alkali Cleaner	30%
P11-040	Alkali Cleaner	30%
P11-044	Alkali Cleaner	25%
P11-045	Alkali Cleaner	25%
P11-071	Aqueous Cleaner	20%
P11-072	Aqueous Degreaser	25%
P11-073	Aqueous Degreaser	50%
P11-079	Aqueous Degreaser	20%
P11-080	Aqueous Degreaser	25%
P11-081	Aqueous Cleaner	30%
P11-082	Aqueous Degreaser	25%
R P11-083	Aqueous Cleaner	20%

R - Apply one of the subsequent gel-type cleaners with the correct
R spray applicator. Do not use a steam machine to apply the gel-type
R cleaner.
NOTE : It is necessary to use a special applicator to apply the gel-type cleaners. Refer to the gel manufacturer's instructions for the correct applicator.

Specification (Material No.)	Name	Concentration
P11-047	Alkaline Gel Cleaner	As received
P11-048	Alkaline Gel Cleaner	As received
P11-069	Alkaline Gel Cleaner	As received
P11-070	Alkaline Gel Cleaner	As received

3 Let the cleaner solution or gel-type cleaner stay on the engine for 10 - 20 minutes.
4 Flush the engine fully with warm or hot water, or with steam.
5 Remove the covers from all the openings on the engine.

R (b)Method B (local application only). Use on of these procedures :
R 1 Apply aqueous cleaner (Material No.P11-049), as received, by
R spray or with a cloth. If necessary, use a soft brush (not made
R of metal) or a scrub pad (Material No.P05-421 or P05-422) to clean
R the engine.
WARNING : SPOP 208 SOLVENTS ARE FLAMMABLE. IF YOU USE SPOP 208 ON HOT ENGINE PARTS, THERE WILL BE AN INCREASED RISK OF FIRE.
R 2 Use a brush (not made of metal), a scrub pad (Material No. P05-421
R or P05-422), or a clean cloth to apply a solvent from SPOP 208 (Ref. 70-00-00, P. Block 201). Wipe dry with a clean cloth.
- If engine parts are hot, let the temperature of the parts decrease to a temperature at which you can touch the parts without gloves, and then apply the SPOP 208 solvent (Ref. 70-00-00, P. Block 201).

(3)Procedure to clean the engine external component parts after removal of the parts from the engine.
(a)When it is necessary to clean engine external component parts after removal of the parts from the engine, do one of the subsequent procedures to clean the parts :
R 1 Do the Method A above.
R 2 Do the Method B above.
3 Do the subsequent procedure :
- Apply stoddard solvent (Material No. P11-027) to the parts with a brush in a solvent-recirculating parts washer or washer/soak tank that uses a recirculating pump to supply filtered solvent to the brush through a flexible supply hose.
- Wipe the parts dry with a clean cloth.

R 26.(SPOP 2) Local Removal of Carbon by Alkaline Gel

A. Reason For the Job
(1)This task gives the necessary instructions for the cleaning of coke from removed engine parts.

B. Equipment and Materials

ITEM	DESIGNATION
(1)Material No.P11-053	Cleaning Agents (Ref. 70-00-00)

C. Procedure - General Instructions

NOTE : This SPOP is approved for use on magnesium, steel, nickel, cobalt, and titanium.

WARNING: REFER TO THE MANUFACTURER'S MATERIAL SAFETY DATA SHEETS FOR CONSUMABLE MATERIAL'S INFORMATION SUCH AS: HAZARDOUS INGREDIENTS, PHYSICAL/CHEMICAL CHARACTERISTICS, FIRE, EXPLOSION, REACTIVITY, HEALTH HAZARD DATA, PRECAUTIONS FOR SAFE HANDLING, USE AND CONTROL MEASURES.

CAUTION : DO NOT USE THIS SPOP ON ALUMINUM, CARBON SEALS OR BEARING. DO NOT USE THIS SPOP ON TUBES WITH ALUMINUM FITTINGS. DO NOT IMMERSE INSULATED TUBES. IF YOU DO, DAMAGE TO THE PARTS CAN OCCUR.

CAUTION : DO NOT USE A WIRE BRUSH. WIRE BRUSHES CAN CAUSE SCRATCHES THAT ROUGHEN THE SURFACE AND INCREASE THE POSSIBILITY OF COKE FORMATION. THESE SCRATCHES CAN ALSO CAUSE CRACKS TO FORM WHICH CAN RESULT IN FAILURE OF THE TUBE.

(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
(2)Do not use this SPOP 2 on any parts made of aluminum, on carbon seals, or on bearings.
(3)Do not immerse tubes with insulation or heatshields in the gel.
(4)Do not use a wire brush.

D. Procedure - Remove Carbon by Alkaline Gel

(1)Mask or plug the part, if necessary.
(2)Apply the Alkaline Gel Cleaner (Material No.P11-053) to the part at ambient temperature.
NOTE : Do not dilute. Do not make a solution.
(3)For carbon removal from tubes, pump or pour the cleaner into the tubes for soak.
(4)Soak the part by one of the steps that follow :
(a)Soak the part for 10 minutes to 12 hours.
(b)For more effective removal of heavy carbon, soak the part in two-hour increments ; then, flush with water and apply the alkaline gel again.
(5)Flush fully with cold or hot water pressure spray.
(6)Remove masking or plugs.
(7)Do an inspection for the removal of carbon with a borescope if used to clean the inner diameter of a tube or internal cavity.
(a)If necessary, do the procedure again.
(b)Maximum soak time is 24 hours.

R 27.(SPOP 6) Cleaning of Electrical Wiring Harnesses and Contact Points

A. Equipment and Materials

ITEM	DESIGNATION
(1)Material No.P05-005	Special Materials (Ref. 70-00-00)
(2)Material No.P11-014A	Cleaning Agents (Ref. 70-00-00)
(3)Material No.P11-055	Cleaning Agents (Ref. 70-00-00)
(4)Material No.P11-056	Cleaning Agents (Ref. 70-00-00)
(5)Material No.P11-057	Cleaning Agents (Ref. 70-00-00)

ITEM	DESIGNATION
(6)Material No.P11-058	Cleaning Agents (Ref. 70-00-00)
(7)Material No.P11-059	Cleaning Agents (Ref. 70-00-00)
(8)Material No.P11-060	Cleaning Agents (Ref. 70-00-00)
(9)Material No.P11-062	Cleaning Agents (Ref. 70-00-00)
(10)Material No.P11-064	Cleaning Agents (Ref. 70-00-00)

B. Procedure - Cleaning Instructions
(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
(2)Spray one of these materials on the harnesses and the connector contacts.
(a)Reagent Grade Isopropyl Alcohol (Material No.P11-014A)
(b)Cleaner Solvent (Material No.P11-055)
(c)Cleaner Solvent (Material No.P11-056)
(d)Cleaner Solvent (Material No.P11-057)
(e)Cleaner Solvent (Material No.P11-058)
(f)Cleaner Solvent (Material No.P11-059)
(g)Cleaner Solvent (Material No.P11-060)
(h)Ultra High Purity Dielectric Solvent (Material No.P11-062)
R (j)Cleaner Solvent (Material No.P11-064)
(3)Wipe clean the area with a Lint-Free Cotton Cloth (Material No.P05-005).
(4)Let the connector dry or blow dry with clean air at 30 psi (206.8 kPa).
(5)You can use a contact enhancer. Refer to Enhancement of Electrical Connector Contacts (SPOP 430) (Ref. 70-00-00, P. Block 201).

R 28.(SPOP 42) Anodize Touch-up

A. Equipment and Materials

ITEM	DESIGNATION
(1)	Brush
(2)	Cloth
(3)	Cotton Swab
(4)	Clean Mixing Container
(5)Material No.P05-028	Special Materials (Ref. 70-00-00)
(6)Material No.P05-029	Special Materials (Ref. 70-00-00)
(7)Material No.P05-030	Special Materials (Ref. 70-00-00)
(8)Material No.P05-060	Special Materials (Ref. 70-00-00)
(9)Material No.P05-061	Special Materials (Ref. 70-00-00)
(10)Material No.P05-062	Special Materials (Ref. 70-00-00)

B. Procedure
WARNING: REFER TO THE MANUFACTURER'S MATERIAL SAFETY DATA SHEETS FOR CONSUMABLE MATERIAL'S INFORMATION SUCH AS: HAZARDOUS INGREDIENTS, PHYSICAL/CHEMICAL CHARACTERISTICS, FIRE, EXPLOSION, REACTIVITY, HEALTH HAZARD DATA, PRECAUTIONS FOR SAFE HANDLING, USE AND CONTROL MEASURES.

(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks. Do this task only when specified by the specific AMM maintenance task.
(2)For repair of AMS 2473 parts, prepare approximately one pint or 16 oz (454.0 g) of the Anodize Touch-up Solution A as follows.
  (a)Put 8 oz (227.0 g) of Demineralized Water (Material No.P05-006) in a clean container.
    NOTE : The demineralized water must have a chloride content of 10 PPM maximum.
  (b)Add 0.5 oz (14175.0 mg) of Aluminum Chromate Conversion Salt (Material No.P05-029) to the container.
  (c)Add 0.0085 oz (241.0 mg) of the Wetting Agent (Material No.P05-030) to the container.
  (d)Mix the solution together.
  (e)Add 8 oz (227.0 g) more of Demineralized Water (Material No.P05-060).
    NOTE : The demineralized water must have a chloride content of 10 PPM maximum.
  (f)Mix the solution.
    NOTE : The working life of the anodize touch-up solution is 14 days. The solution must be identified as to the time and date of mixing. Discard the solution after 14 days.
(3)For repair of AMS 2474 parts, prepare approximately 1 pint or 16 oz (454.0 g) of the Anodize Touch-up Solution B as follows.
  (a)Put 8 oz (227.0 g) of potable water in a clean container.
  (b)Add 0.25 oz (7087.0 mg) of Aluminum Chromate Conversion Salt (Material No.P05-028) to the container.
  (c)Mix the solution together.
  (d)Add 8 oz (227.0 g) more of potable water.
  (e)Mix the solution.
    NOTE : The working life of the anodize touch-up solution is 14 days. The solution must be identified as to the time and date of mixing. Discard the solution after 14 days.
(4)Apply Anodize Touch-up Solution A or B to the reapir area as follows.
  (a)Clean the repair area. Refer to Degrease Engine Parts by Solvent Wipe (SPOP 208) (Ref. 70-00-00, P. Block 201).
    1 If dirt and grease remain on the surface, use Crocus Cloth (Material No.P05-061) or Emery Cloth (Material No.P05-062) to clean the repair area.
  (b)Apply the Anodize Touch-up Solution to the repair area with a clean brush or cotton swab.
    NOTE : The Anodize Touch-up Solution must wet the surface for approximately four minutes. If the solution does not wet the surface, remove the anodize touch-up solution with a clean cloth and reapply.
  (c)Let the anodize solution air dry.
(5)Examine the repair area for full coverage of the Anodize Touch-up Solution.
  (a)For Anodize Touch-up Solution A, the color must be brown.
  (b)For Anodize Touch-up Solution B, the color must be iridescent gold-to-tan.
(6)Smooth the repair area with a clean cloth.

R 29. (SPOP 70) Fluorescent Penetrant Inspection (Local Application) Normal or High or Ultra High Sensitivity

NOTE : SPOP 70 is intended for the inspection of the small areas of apart (such as, bosses, weld repaired areas, rout outs or grind outs and blended areas). It is not intended to be used for full circumference (360 degree) inspections (for example, flanges, seals, knife-edges) or to replace a 100 percent inspection. When you do SPOP 70, do not use excessive wiping because it can remove too much penetrant from a defect.

A. Equipment and Materials

ITEM	DESIGNATION
(1)	UV Light
(2)	UV Light Meter
(3)	White Light Meter
(4)Material No.P05-032	Special Materials (Ref. 70-00-00)
(5)Material No.P05-034	Special Materials (Ref. 70-00-00)
(6)Material No.P05-234	Special Materials (Ref. 70-00-00)
(7)Material No.P05-235	Special Materials (Ref. 70-00-00)
(8)Material No.P05-236	Special Materials (Ref. 70-00-00)
(9)Material No.P05-237	Special Materials (Ref. 70-00-00)
(10)Material No.P05-424	Special Materials (Ref. 70-00-00)
(11)Material No.P11-014	Cleaning Agents (Ref. 70-00-00)
(12)Material No.P11-032	Cleaning Agents (Ref. 70-00-00)
(13)Material No.P11-038	Cleaning Agents (Ref. 70-00-00)
(14)Material No.P11-039	Cleaning Agents (Ref. 70-00-00)
(15)Material No.P11-042	Cleaning Agents (Ref. 70-00-00)

B. Procedure - General Instructions

(1) Always obey the specific procedures and limits in the AMM maintenance task.

CAUTION : DO NOT USE A VISIBLE DYE PENETRANT ON AN ENGINE PART BEFORE YOU INSPECT THE PART WITH FLUORESCENT PENETRANT. FLUORESCENT PENETRANTS AND VISIBLE DYE PENETRANTS ARE NOT COMPATIBLE WITH EACH OTHER. THE ABSORPTION OF VISIBLE DYE PENETRANT WILL MASK INDICATIONS AND DECREASE THE SENSITIVITY OF THE FLUORESCENT PENETRANT INSPECTION.

CAUTION : DURING INSPECTION, DO NOT WEAR EYE GLASSES THAT HAVE LENSES WHICH DARKEN WHEN THEY ARE IN ULTRAVIOLET LIGHT.

(2) Always use SPOP 70 "ultra" high sensitivity penetrant on major rotating parts (compressor airseals, drums, fan blades, compressor blades, hubs, disks; turbine disks, airseals, hubs, seal plates (full rings and segments) and shafts). In some tasks the "ultra" high sensitivity penetrant is not specified on these major rotating parts. Service experience shows that "ultra" high sensitivity penetrant must be used (instead of high) on all major rotating parts.

C. Procedure - Cleaning Instructions

(1)Wipe the inspection area with a clean cloth wet with a solvent from SPOP 208. Refer to Degreasing of Parts by Solvent Wiping (SPOP 208) (Ref. 70-00-00, P. Block 201).
(2)Remove all unwanted material.

D. Procedure - Inspection Instructions
(1)Do not permit liquid to run over or flood any surface.
(2)Mask surrounding area with masking tape, as necessary, to prevent penetrant contamination where it is not wanted.
(3)Apply the applicable penetrant (normal, high, or ultra high), as specified by the specific AMM maintenance task, with a brush, cloth, or cotton swab for 20 to 60 minutes.
(a)Do not mix different types or brands of penetrant.
(b)Normal penetrants
1 Fluorescent Penetrant (post-emulsified) (PMC 4352) (Material No.P05-234).
(c)High penetrants
1 Fluorescent Penetrant (Post-Emulsified) (PMC 4353) (Material No.P05-032).
2 Fluorescent Penetrant (Water Washable) (PMC 4360) (Material No.P05-236).
3 Fluorescent Penetrant (Water Washable) (PMC 4351) (Material No.P05-424).
(d)Ultra high penetrants
1 Fluorescent Penetrant (Post-Emulsified) (PMC 4354) (Material No.P05-235).
(4)Drain/dwell for 20 to 60 minutes maximum.
(5)Wipe surfaces with a cloth or paper towel and a SPOP 208 solvent to remove surface penetrant.
NOTE : Use the solvent only to moisten the wiper and only if necessary.
(6)Use the UV light to make sure that there is no more penetrant on the surface.
(7)Very lightly apply the developer as follows.
(a)Nonaqueous developer
1 Fluorescent Penetrant Developer (Nonaqueous) (PMC 4357) (Material No.P05-237).
2 If this nonaqueous developer is used, apply a constant thickness of the non-aqueous developer such that you can see the developer and the color of the part.
(b)Dry developer
1 Dry Developer (PMC 4356) (Material No.P05-034).
(8)Wait a minimum of 10 minutes for development.
CAUTION : YOU MUST DO THIS INSPECTION IN A DARK AREA. WHITE LIGHT MUST NOT BE MORE THAN 2 FOOTCANDLES (20 LUX) AT THE INSPECTION SURFACE TO MAKE THE AREA DARK, YOU CAN COVER IT WITH A BLACK CLOTH.
(9)Examine the part number under ultraviolet light (UVL) for indications.
(10)If any area shows moderate fluorescent background or any marginally unacceptable or questionable indication, continue as follows.
(a)Lightly rub the suspect area with a soft brush or cotton swab wet with a solvent from SPOP 208. Refer to Degreasing of Parts by Solvent Wiping

(SPOP 208) (Ref. 70-00-00, P. Block 201).
(b)Do not permit liquid to run over or flood any surface.
(c)Permit liquid to evaporate from surface.
(d)Apply the dry or non-aqueous developer to the area in question and examine again under UVL.
(e)If the indication reappears immediately, evaluate immediately.
(f)If the indication does not reappear immediately then apply the dry developer (PMC 4356) (Material No. P05-469) or the non-aqueous developer (PMC) 4357) (Material No. P05-237) to the area. Wait a minimum of 10 minutes for redevelopment, then examine again.
NOTE : No cracks are permitted unless specified differently.
(g)Use this evaluation procedure only once on an indication.
(11)Remove the developer. Refer to Degreasing of Parts by Solvent Wiping (SPOP 208) (Ref. 70-00-00, P. Block 201).
NOTE : Removal of developer is only necessary if it interferes with subsequent processing or part function.
NOTE : For parts with no areas of entrapment that are to go visual/dimensional inspection, blow off any remaining developer, if necessary.
NOTE : For parts that can cause entrapment of dry developer, flush with hot water to clean.

R 30. (SPOP 148) Application of Epoxy Primer and Aluminized Epoxy Enamel

A. Equipment and Materials

ITEM	DESIGNATION
(1)Material No.P05-037	Special Materials (Ref. 70-00-00)
(2)Material No.P05-063	Special Materials (Ref. 70-00-00)
(3)Material No.P05-076	Special Materials (Ref. 70-00-00)
(4)Material No.P05-255	Special Materials (Ref. 70-00-00)
R (5)Material No.P05-482	Special Materials (Ref. 70-00-00)
R (6)Material No.P05-483	Special Materials (Ref. 70-00-00)
R (7)Material No.P11-065	Cleaning Agents (Ref. 70-00-00)
R (8)Material No.P18-020	Primers (Ref. 70-00-00)
R (9)Material No.P18-024	Primers (Ref. 70-00-00)

B. Procedure
(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
(2)Clean the repair area. Refer to Degrease Engine Parts by Solvent Wipe - SPOP 208 (Ref. 70-00-00, P. Block 201).
(3)Use 400 Grit Abrasive Paper (Material No.P05-076).
(4)Clean the repair area again. Refer to Degrease Engine Parts by Solvent Wipe - SPOP 208 (Ref. 70-00-00, P.Block 201).
(5)Apply Masking Tape (Material No.P05-255) to the areas not to be painted.
R (6)Prepare the applicable Epoxy Primer (Material No. P18-020 or
R Material No. P18-024) as follows :
R NOTE : The working life of the Epoxy Primer (Material No. P18-020
R or Material No. P018-024) mixture is approximately four hours at

60 - 80°F (16 - 27°C). Be sure to identify the time and date of the mixture.

CAUTION : DO NOT INTERMIX THE BASE-CURING SOLUTION-SOLVENT SYSTEMS.

(a)Mix the applicable Epoxy Primer (Material No. P18-020 or Material No. 18-024) as follows :

NOTE : To correctly measure the ratio of components to mix, it is necessary to use a graduated cylinder or beaker. An incorrect ratio of base to catalyst will decrease primer performance.

1 For Epoxy Primer (Material No. P18-020)

NOTE : The Epoxy Primer (Material No. P18-020) comes in green (PWA 36519-1) or black (PWA 36519-2). You can use either suffix when no suffix is specified, but PWA 36519-2 is preferred because it does not contain MEK and is less hazardous than PWA 36519-1.

- Stir the primer base until there is no solid material remaining on the bottom of the container.
- Mix three parts by volume of the primer base with one part by volume of the curing solution.
- If necessary, dilute the green Epoxy Primer (PWA 36519-1) with Acetone (Material No. P11-065) in a ratio of four parts primer to one part acetone by volume. It is not necessary to dilute the black Epoxy Primer (PWA 36519-2). Stir fully.

NOTE : For Epoxy Primer (Material No. P18-020), it is permitted to decrease the volume of solvent for applications by brush.

2 For Epoxy Primer (Material No. P18-024)

NOTE : The Epoxy Primer (Material No. P18-024) is a dark gray primer. This primer does not contain MEK and is less hazardous than the green PWA 36519-1.

- Stir the primer base until there is no solid material remaining on the bottom of the container.
- Mix seven parts by volume of the primer base with one part by volume of the curing solution. No dilution is necessary.

(7)Apply a thin coat of Epoxy Primer (Material No. P18-020 or Material No. P18-024) to the repair area with a standard paint air supply gun and filtered air supply. Air dry between coats for 5 - 10 minutes.

NOTE : To get sufficient coverage of the repair area, multiple coats of the Epoxy Primer (Material No. P18-020 or Material No. P18-024) can be necessary.

(8)Let the Epoxy Primer (Material No. P18-020 or Material No. P18-024) cure for a minimum of one hour.

(9)Prepare the applicable Aluminized Epoxy Enamel (Material No. P05-037 or Material No. P05-483) as follows :

(a)For Aluminized Epoxy Enamel (Material No. P05-037)

NOTE : The working life of the Aluminized Epoxy Enamel (Material No. P05-037) mixture is approximately eight hours at 60 - 80°F (16 - 27°C). Be sure to record the time and date of mixing.

1 Stir the enamel base until there is no solid material remaining on the bottom of the container.

2 Mix one part by volume of the enamel base with one part by volume of the curing solution.

R 3 If necessary, add Solvent Reducer (Material No. P05-063) to the Aluminized Epoxy Enamel (Material No. P05-037) mixture to make the mixture sprayable.
R 4 Let the Aluminized Epoxy Enamel (Material No. P05-037) become stable for one hour before you use the mixture.
R (b)For Aluminized Epoxy Enamel (Material No. P05-483)
R NOTE : The working life of the Aluminized Epoxy Enamel (Material No. P05-483) is approximately four hours at 60 - 80°F (16 - 27°C). Be sure to record the time and date of mixing.
R 1 Stir the enamel base until there is no solid material remaining on the bottom of the container.
R 2 Mix three parts by volume of the enamel base with one part by volume of the curing solution.
R 3 If necessary, add Solvent Reducer (Material No. P05-482) to the Aluminized Epoxy Enamel (Material No. P05-483) mixture to make the mixture sprayable.
R 4 Let the Aluminized Epoxy Enamel (Material No. P05-483) become stable for 15 minutes minimum before you use the mixture.
R (10)Apply one coat of the Aluminized Epoxy Enamel (Material No. P05-037 or Material No. P05-483) mixture to the repair area with a standard paint air supply gun and filtered air supply.
R (11)Cure the Aluminized Epoxy Enamel (Material No. P05-037 or Material No. P05-483) as follows :
R (a)For Aluminized Epoxy Enamel (Material No. P05-037)
R 1 Cure Aluminized Epoxy Enamel (Material No. P05-037) with a heat gun at 140 - 180°F (60 - 82°C) for one hour.
R (b)For Aluminized Epoxy Enamel (Material No. P05-483)
R 1 Air dry the Aluminum Epoxy Enamel (Material No. P05-483) for a minimum of 24 hours at room temperature to cure the coating sufficiently for handling purposes only.
R 2 Air dry the Aluminum Epoxy Enamel (Material No. P05-483) for seven days for full chemical resistance.
(12)Carefully remove the masking tape.
(13)Examine the repair area for full coverage of the aluminized epoxy enamel.

R 31. (SPOP 201) Removal of Carbon From Fuel and Oil Tubes (Bake Method)

A. Procedure
WARNING: REFER TO THE MANUFACTURER'S MATERIAL SAFETY DATA SHEETS FOR CONSUMABLE MATERIAL'S INFORMATION SUCH AS : HAZARDOUS INGREDIENTS, PHYSICAL/CHEMICAL CHARACTERISTICS, FIRE, EXPLOSION, REACTIVITY, HEALTH HAZARD DATA, PRECAUTIONS FOR SAFE HANDLING, USE AND CONTROL MEASURES.
(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
CAUTION : DO NOT USE THIS PROCESS ON TUBES WITH ALUMINUM FITTINGS.
CAUTION : DO NOT IMMERSE INSULATED TUBES. DO NOT USE WIRE BRUSHES. WIRE BRUSHES CAN CAUSE SCRATCHES THAT MAKE THE SURFACE ROUGH AND MAKE THE COKE CONDITION MORE POSSIBLE. THESE SCRATCHES CAN ALSO CAUSE CRACKS TO OCCUR AND THE RESULT CAN BE POSSIBLE FAILURE OF THE TUBE.

(2)Remove carbon from fuel and oil tubes by the bake method as follows :
(a)Degrease the tube, if necessary, with SPOP 209 (Ref. 70-00-00, P. Block 201).
(b)Put the tube in an oven at 800-900 °F (427-482 °C) for one hour.
(c)Blow the tube clean with air.
(d)Do an inspection with a borescope to make sure that all carbon is fully removed. If carbon stays, put a plastic flex rod through the tube to remove remaining carbon.
NOTE : If you have access to an engine shop clean line, you can use SPOP 19 dry plastic blast method as an option.
(e)Blow the tube clean with air.
(f)If necessary, do this task again.

R 32.(SPOP 208) Degrease Engine Parts by Solvent Wipe

A. Equipment and Materials

ITEM	DESIGNATION
(1)Material No.P05-005	Special Materials (Ref. 70-00-00)
(2)Material No.P11-005	Cleaning Agents (Ref. 70-00-00)
(3)Material No.P11-005A	Cleaning Agents (Ref. 70-00-00)
(4)Material No.P11-014	Cleaning Agents (Ref. 70-00-00)
(5)Material No.P11-014A	Cleaning Agents (Ref. 70-00-00)
(6)Material No.P11-032	Cleaning Agents (Ref. 70-00-00)
(7)Material No.P11-038	Cleaning Agents (Ref. 70-00-00)
(8)Material No.P11-039	Cleaning Agents (Ref. 70-00-00)
(9)Material No.P11-042	Cleaning Agents (Ref. 70-00-00)
(10)Material No.P11-055	Cleaning Agents (Ref. 70-00-00)
(11)Material No.P11-056	Cleaning Agents (Ref. 70-00-00)
(12)Material No.P11-057	Cleaning Agents (Ref. 70-00-00)
(13)Material No.P11-058	Cleaning Agents (Ref. 70-00-00)
(14)Material No.P11-059	Cleaning Agents (Ref. 70-00-00)
(15)Material No.P11-062	Cleaning Agents (Ref. 70-00-00)
(16)Material No.P11-063	Cleaning Agents (Ref. 70-00-00)
(17)Material No.P11-064	Cleaning Agents (Ref. 70-00-00)
(18)Material No.P11-065	Cleaning Agents (Ref. 70-00-00)
(19)Material No.P11-066	Cleaning Agents (Ref. 70-00-00)
(20)Material No.P11-067	Cleaning Agents (Ref. 70-00-00)
(21)Material No.P11-074	Cleaning Agents (Ref. 70-00-00)
(22)Material No.P11-075	Cleaning Agents (Ref. 70-00-00)
(23)Material No.P11-076	Cleaning Agents (Ref. 70-00-00)
(24)Material No.P11-077	Cleaning Agents (Ref. 70-00-00)

B. Procedure - General Instructions
WARNING : REFER TO THE MANUFACTURER'S MATERIAL SAFETY DATA SHEETS FOR CONSUMABLE MATERIAL'S INFORMATION SUCH AS: HAZARDOUS INGREDIENTS, PHYSICAL/CHEMICAL CHARACTERISTICS, FIRE, EXPLOSION, REACTIVITY, HEALTH HAZARD DATA, PRECAUTIONS FOR SAFE HANDLING, USE AND CONTROL MEASURES.
(1)Always obey the specific procedures and limits in the specific AMM main-

tenance tasks.

(2)This SPOP 208 procedure is for use on titanium and non-titanium parts.

CAUTION : SIZED CHEESECLOTH CONTAINS RESIN BINDERS THAT CAN DISSOLVE IN SOLVENTS AND CAUSE CONTAMINATION OF BOND SURFACES AND PREVENT A GOOD ADHESIVE BOND.

(3)Do not use sized cheesecloth with solvents.

(4)Methanol or halogenated hydrocarbon solvents are not permitted in SPOP 208.

C. Procedure - Degrease Engine parts by Solvent Wipe

WARNING : THE SOLVENTS IN THIS PROCEDURE ARE FLAMMABLE.

CAUTION : DO NOT PUT PART ASSEMBLIES THAT CONTAIN MATERIALS THAT ARE NOT METALLIC FULLY IN SOLVENTS.

CAUTION : DO NOT DIP (PUT MOMENTARILY) THE WIPING CLOTH IN THE SOLVENT CONTAINER. THIS CAN CAUSE CONTAMINATION OF THE SOLVENT, WHICH CAN CAUSE CONTAMINATION OF THE PART SURFACES AND PREVENT A GOOD BOND WITH ADHESIVES OR PAINTS.

(1)Wipe the part with an unsized, clean, white, lint free cotton cloth (Material No. P05-005) that is wet with one of these applicable solvents :

NOTE : Be sure to wear clean cotton gloves to touch clean parts before adhesive bonding.

(a)See Table 201 for descriptions and letter codes of solvents approved to use on metallic or non-metallic parts.

(b)See Table 202 for the solvents that are approved to degrease metallic parts for general wiping, for local fluorescent penetrant inspection (FPI) or before adhesive bonding or painting.

(c)See Table 203 for the solvents that are approved to degrease non-metallic parts for general wipe cleaning, or before painting or adhesive bonding.

(2)Air dry the parts.

(a)Do not use compressed air to dry parts before adhesive bonding or painting. Compressed air can contain oil vapors.

LETTER CODE	MATERIAL No.	DESCRIPTION	FLASHPOINT	VAPOR PRESSURE
A	P11-005A	METHYL ETHYL KETONE (REAGENT GRADE)	<140°F (60°C)	>45mm Hg
B	P11-065	ACETONE (REAGENT GRADE)	<140°F (60°C)	>45mm Hg
C	P11-042	FLUORESCENT PENETRANT CLEANER/REMOVER	<140°F (60°C)	>45mm Hg
D	P11-055	SOLVENT CLEANER	≥140°F (60°C)	≤45mm Hg
E	P11-063	HAND-WIPING SOLVENT	≥140°F (60°C)	≤45mm Hg
F	P11-062	DIELECTRIC SOLVENT	≥140°F (60°C)	≤45mm Hg

LETTER CODE	MATERIAL No.	DESCRIPTION	FLASHPOINT	VAPOR PRESSURE
G	P11-066	HAND-WIPING SOLVENT	<140°F (60°C)	≤45mm Hg
H	P11-032	ACETONE (TECHNICAL GRADE)	<140°F (60°C)	>45mm Hg
I	P11-014A	ISOPROPRYL ALCOHOL (REAGENT GRADE)	<140°F (60°C)	≤45mm Hg
J	P11-039	SOLVENT CLEANER	<140°F (60°C)	>45mm Hg
K	P11-005	METHYL ETHYL KETONE (TECHNICAL GRADE)	<140°F (60°C)	>45mm Hg
L	P11-014	ISOPROPRYL ALCOHOL (TECHNICAL GRADE)	<140°F (60°C)	≤45mm Hg
M	P11-056	CLEANER SOLVENT	≥140°F (60°C)	≤45mm Hg
N	P11-057	CLEANER SOLVENT	≥140°F (60°C)	≤45mm Hg
O	P11-067	CLEANER SOLVENT	≥140°F (60°C)	≤45mm Hg
P	P11-058	CLEANER SOLVENT	<140°F (60°C)	≤45mm Hg
Q	P11-059	CLEANER SOLVENT	<140°F (60°C)	≤45mm Hg
R	P11-064	CLEANER SOLVENT	≥140°F (60°C)	≤45mm Hg
S	P11-074	CLEANER SOLVENT	<140°F (60°C)	≤45mm Hg
T	P11-075	CLEANER SOLVENT WIPES	<140°F (60°C)	≤45mm Hg
U	P11-076	CLEANER SOLVENT	<140°F (60°C)	≤45mm Hg
V	P11-077	CLEANER SOLVENT WIPES	<140°F (60°C)	≤45mm Hg

Descriptions And Letter Codes of Solvents
Approved to Use On Metallic or Non-Metallic Parts
Table 201

APPLICATION	SOLVENTS APPROVED TO DEGREASE METALLIC PARTS*
FPI (LOCAL)	A B C G H I J K L P Q S T
GENERAL WIPE	A B C D E F G H I J K L M N O P Q R S T U V
PRE-ADHESIVE BONDING	A B C G I J P Q S T

APPLICATION	SOLVENTS APPROVED TO DEGREASE METALLIC PARTS*
PRE-PAINTING	A B C G I J P Q S T U V

* See Table 201 for solvent letter codes.

Solvents Approved to Degrease Metallic Parts
Table 202

SPEC. No.	NON-METALLIC PART DESCRIPTION OF MATERIAL	SOLVENTS APPROVED TO DEGREASE NON-METALLIC PARTS*
PWA 410	FIBERGLASS STRUCTURES, LAMINATED MOLDINGS	A B C G H I J K L P Q
PWA 411	CLOTH, GLASS, EXPOXY RESIN IMPREGNATED	A B C G H I J K L P Q
PWA 446	POLYURETHAN RESIN, FOAMING	I
PWA 459	FABRIC, AROMATIC POLYAMIDE, EPOXY RESIN IMPREGNATED	A B C G H I J K L P Q
PWA 460	LAMINATED STRUCTURES, AROMATIC POLYAMIDE FABRIC - EPOXY RESIN MATRIX	A B C G H I J K L P Q
PWA 479	MOLDING COMPOUND, POLYAMIDE, COMPOSITE	B I
PWA 628	FOAM, MOLDED POLYURETHANE	I
PWA 36013	POLYURETHANE COATING, CONDUCTIVE, BLACK	I
PWA 36014	POLYURETHANE SURFACER, WHITE	I
PWA 36151	COMPOSITE AIRFOILS, CARBON FIBER REINFORCED	A B C G H I J K L P Q
PWA 36408	FABRIC, CARBON FIBER AND FIBERGLASS, POLYIMIDE RESIN IMPREGNATED	B I
PWA 36414	FABRIC, ALUMINUM BOROSILICATE GLASS FIBER, EPOXY RESIN IMPREGNATED	B I
PWA 36422	FABRIC, FIBERGLASS, EPOXY RESIN	A B C G H I J K L P Q

SPEC. No.	NON-METALLIC PART DESCRIPTION OF MATERIAL IMPREGNATED	SOLVENTS APPROVED TO DEGREASE NON-METALLIC PARTS*
PWA 36426	MOLDING COMPOUND, POLYETHERIMIDE COMPOSITE	B
PWA 36442	FLUOROELASTOMER SHEET	I
PWA 36509	PRIMER, POLYURETHANE	I
PWA 36510	COATING, POLYURETHANE, EROSION RESISTANT	I
PWA 36516	FLUOROELASTOMER COATING	I

* See Table 201 for the solvent letter codes.

Solvents Approved to Degrease Non-Metallic Parts
Table 203

R 33. (SPOP 209) Degrease Parts by Aqueous Cleaner (No Rinse)

A. Reason for the Job
(1)This task gives the necessary instructions for the cleaning of the engine external parts with PWA 77 and PWA 110 (PWA 595) coatings.

B. Equipment and Materials

ITEM	DESIGNATION
(1)Material No.P05-005	Special Materials (Ref. 70-00-00)
(2)Material No.P11-049	Cleaning Agents (Ref. 70-00-00)

C. Procedure - Degreasing of Parts by Aqueous Cleaning (Aqueous Spray or Wiping Without Rinse)
(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
WARNING : REFER TO THE MANUFACTURER'S MATERIAL SAFETY DATA SHEETS FOR CONSUMABLE MATERIAL'S INFORMATION SUCH AS: HAZARDOUS INGREDIENTS, PHYSICAL/CHEMICAL CHARACTERISTICS, FIRE, EXPLOSION, REACTIVITY, HEALTH HAZARD DATA, PRECAUTIONS FOR SAFE HANDLING, USE AND CONTROL MEASURES.
(2)Remove light oils, grease, fingerprints, dust, and soot from engine external part by the subsequent steps :
CAUTION : PARTS COATED WITH PWA 77 DIFFUSED ALUMINIDE CAN BE CLEANED ONLY WITH SPOP 209 AQUEOUS DEGREASING. THE USE OF OTHER ALKALINE CLEANERS WILL CAUSE DETERIORATION OR REMOVAL OF THIS COATING.
CAUTION : PARTS COATED WITH PWA 110 (PWA 595) ALUMINUM COATING CAN BE CLEANED ONLY WITH SPOP 209. THE USE OF OTHER ALKALINE

CLEANERS WILL CAUSE DETERIORATION OR REMOVAL OF THIS COATING.

(a)Degrease the part by one of the subsequent steps :

1 Wipe the part with a clean lint free cotton cloth (Material No. P05-005) wet with aqueous cleaner (Material No. P11-049).
- Use the aqueous cleaner as received.
- Do not dilute the aqueous cleaner or make a solution.
- Pour the solvent onto the cloth to keep unwanted material from the wiping solvent.
- Do not dip the cloth into the solvent container.

2 Spray the aqueous cleaner on the part.

(b)If necessary, scrub the part with a soft non-metallic brush or pad.

(c)Wipe the part dry with a clean lint free cotton cloth (Material No. P05-005).

R 34.(SPOP 416) Removal of Broken Bolts or Studs and Installation of
R Oversize Studs

A. General

(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2)This task gives the general instructions and equipment necessary for the removal of broken bolts or studs and the installation of oversize studs.

R B. Procedure to Remove Broken Bolts or Studs

(1)Remove broken bolts and/or studs by mechanical removal methods, unless specified differently by the AMM maintenance task.

(2)Drill a hole into the end of the broken bolt and/or stud. Refer to the tool manufacturer's instructions for the correct size drill.

(3)Put the extraction tool into the drilled hole and lock into position.

(4)Turn the extraction tool in a counterclockwise direction to remove the broken bolt.

(5)Tap the threads if necessary to clean or chase the threads.

R (6)Examine the threads for damage or an oversize condition. If there is
R thread damage or an oversize condition, do the subsequent procedure
R for the installation of oversize studs.

R C. Procedure for the Installation of Oversize Studs

R (1)General

R (a)Replace studs that are stretched, loose, or have thread damage
R with oversize studs.

R (b)It is permitted to replace an oversize stud to the next oversize
R one time. If more than the second oversize replacement is necessary,
R get approval from :
R Manager of Customer Technical Service (CTS)
R 400 Main Street - Mail Stop 163-20
R East Hartford, CT 06108 USA
R Fax : 1-860-565-9825

R (c)Where the threads of a stud hole have become damaged or stripped,

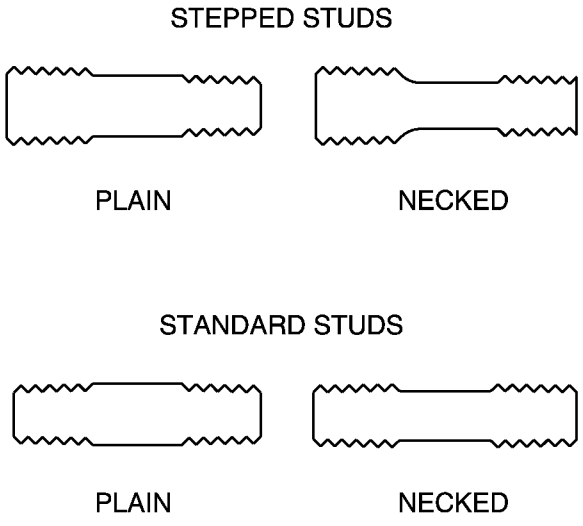
R it is possible, if there is sufficient material around the hole, to
R drill and tap the hole again for a special stepped stud
R (Ref. Fig. 224).
R (d)When you install a stud that incorporates a cotterpin or a safety
R wire hole, measure the projection length from the bottom of the
R stud hole.
R (e)See the specific repair chart applicable to the studs to be replaced.
R (2)Stud torques
R (a)For standard torques, refer to AMM 70-00-00, P. Block 201.
R (3)Stud lubrication
R (a)For information on oil lubricated studs, antigallant lubricated
R studs, and studs in self-locking helical coil inserts, refer to
R AMM 70-00-00, P. Block 201.

R 35. (SPOP 425) Cleaning Requirements After Chemical Contact With Fire Extinguisher Agents, Hydraulic Fluid, Oil, or Fuel

A. Equipment and Materials

ITEM	DESIGNATION
(1)Material No.P11-049	Cleaning Agents (Ref. 70-00-00)

B. Procedure - General Instructions
R (Ref. Fig. 225)
(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
R (2)SPOP 425 gives operators the cleaning and disassembly requirements for
R engines that come in contact with (touch) fire extinguisher agents during
R a fire in the burner (combustor) and/or gaspath areas of the engine, or
R that come in contact with hydraulic fluid, oils, or fuel. Contact (speak
R or write to) the local Pratt & Whitney representative for the applicable
R requirements and procedures when the subsequent conditions occur :
R (a)The engine comes in contact with a fire extinguisher agent when there
R is no fire (for example, during accidental operation of the fire
R extinguisher system).
R (b)The fire temperature was higher than the engine over-temperature
R limits.
R (c)The fire occurred in areas other than the burner and gaspath areas of
R the engine.
R (3)After a fire extinguisher agent goes into the engine, do not operate the
R engine if the table (Ref. Fig. 225) shows that the fire extinguisher
R agent makes it necessary to disassemble the engine.
R Some fire extinguisher agents can cause damage to engine parts at engine
R operation temperatures.
R (4)If you used carbon dioxide, nitrogen, Ansul Inergen, water, or water fog
R to extinguish a tail pipe fire, and the post-fire inspection finds no
R fire damage or mechanical damage, then it will not be necessary to
R disassemble the engine to clean the engine parts (Ref. Fig. 225)
R (Sheet 1). For many other fire extinguisher agents, it is necessary
R to disassemble the engine to satisfactorily clean the parts that came in
R contact with the fire extinguisher agent (Ref. Fig. 225).



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R

Replacement Stud Types
Figure 224

R (5)Before you do maintenance work on a hangar fire extinguisher system that uses foam, remove engines from the hangar or put covers on the engines to make sure that accidental operation of the system does not cause foam to go into the engine.
R (6)Necessary detailed procedures for gaspath cleaning (internal wash), and instructions for subsequent disassembly, cleaning, and inspection, are in the applicable AMM Maintenance Manuals.
R (7)If operators who know of airports, test cells, or hangars that use fire extinguisher agents that are not in the table, (Ref. Fig. 225), they must give instructions to their local Pratt & Whitney representative to send the Technical Data Sheets and Material Safety Data Sheets for these fire extinguisher agents to Pratt & Whitney Customer Service in East Hartford, Connecticut.
R (8)The primary concern when foam or dry chemical fire extinguisher agents go into an engine is corrosion during subsequent engine operation. The engine operation environment can cause chemical reactions of the fire extinguisher agents, which then can cause corrosion on cold-section and/or hot-section parts.
R (9)Test show these results :
R (a)Stainless steel alloys, nickel base alloys (coated or uncoated), and cobalt base alloys, show a high risk of chemical corrosion from some types of fire extinguisher agents (for example, protein foams and dry chemical agents), at temperatures much below the engine operation range.
R (b)Titanium, aluminum, magnesium, cadmium plated and nickel-cadmium plated low alloy steels show no signs of corrosion from bicarbonate compounds (dry powders) at engine operation temperatures.
R (c)Many of the foam fire extinguisher agents in the table (Ref. Fig. 225) (Sheet 2) cause stress corrosion cracks in titanium at the service operation temperatures in the high pressure compressor, but not at the service operation temperatures of the fan. Thus, it is permitted to hand wipe clean with Aqueous Cleaner (Material No. P11-049) to remove overspray of foam fire extinguisher agents from fan blades.
R (d)Some of the aqueous film-forming foam (AFFF) and high-expansion foam chemical fire extinguisher agents in the table (Ref. Fig. 225) (Sheet 2) do not cause corrosion on engine material test panels at engine operation temperatures. The table (Ref. Fig. 225)(Sheet 2) shows which AFFF and high-expansion foam agents have test results that show they are compatible with engine alloys and coatings. For other AFFF and high-expansion foam agents, it is necessary to disassemble the engine to remove the parts that came in contact with the foam.
R (10)Halon 1301 fire extinguisher agent decomposes in fires and at engine operation temperatures to make acids that can cause corrosion of, or stress corrosion cracks in, gaspath materials at high temperatures. Test show that Halon 1301 can degrade turbine airfoil coatings at 1800°F (982°C) in a short period of time.
R (a)Fire extinguisher systems that release Halon 1301 directly into the core of the engine (for example, ground units) can cause the turbofan airfoils to come in contact with the Halon 1301.
R (b)Onboard nacelle halon 1301 fire extinguisher systems usually do not cause the turbine airfoils to come in contact with the Halon 1301

because these systems release the Halon 1301 into the nacelle compartment and not directly into the engine core. Thus, it is usually not necessary to clean engine gaspath parts to remove Halon 1301 decomposition materials after an onboard nacelle fire extinguisher system releases Halon 1301.

(11)The aqueous film-forming foams (AFFF) in the table (Ref. Fig. 225) (Sheet 2) are NFPA Class B foam fire extinguisher agents that use synthetic surfactants, which are usually fluorinated. These foams do not contain protein foaming agents.

(12)The high-expansion foams in the table (Ref. Fig. 225)(Sheet 2) are NFPA Class B foam fire extinguisher agents that expand quickly to fill closed spaces (for example, hangars). These foams usually use synthetic surfactants that are different from the synthetic surfactants in aqueous film-forming foams.

(13)The protein (P), fluoroprotein (FP), and film-forming fluoroprotein (FFFP) foams in the table ((Ref. Fig. 225)(Sheet 2) are NFPA Class B foam fire extinguisher agents that use protein foaming agents.

C. Cleaning After Chemical Contact with Fire Extinguisher Agents

(1)After a fire, or after you use an onboard nacelle fire extinguisher system because of a cockpit fire warning, do an inspection of the engine for fire damage :

(a)Turn the rotor manually to do a check to make sure that the rotor turns freely :

1 The rotor must turn freely. A rotor that does not turn freely is a sign of damage.

2 While the rotor turns, listen for parts that rub against or hit other parts that they usually do not touch. Such noises are signs of damage.

(b)Do a visual inspection of the external surfaces of the engine to look for fire damage.

(c)Do a borescope inspection of the engine to see which parts have fire damage.

(d)If the check for free movement finds one or more signs of damage, the visual inspection finds fire damage, and/or the borescope inspection finds fire damage, then it is necessary to remove the engine from the airframe and to disassemble the engine to remove the parts that have damage.

(2)In engine models that use labyrinth seals, do a check for contamination of the oil systems because the materials in the table (Ref. Fig. 225) could enter the oil system through the labyrinth seals.

(3)See the table (Ref. Fig. 225) for the inspection, cleaning, and disassembly requirements for engines that come in contact with fire extinguisher agents during a fire. The procedures for the requirement in each column of the table (Ref. Fig. 225) are in the subsequent list :

(a)Visual/Borescope Inspection - (Ref. Fig. 225), Column 2

1 If Column 2 says "YES" for the material, do the subsequent procedure :

- Do a visual inspection of the external surfaces of the engine to see which parts have contamination from the material.
- Do an internal borescope inspection to see which parts have contamination from the material.

R NOTE : This inspection will show how much of the engine you must
R disassemble to remove the parts that have contamination from
R the material.
R NOTE : This inspection does not show contamination from gaseous fire
R extinguisher agents or vaporizing liquid fire extinguisher
R agents.
R 2 If Column 2 says "N/R" for the material, it is not required (that is,
R it is permitted, but not necessary) to do a borescope inspection of
R the engine to look for contamination.
R (b)External Wash - (Ref. Fig. 225), Column 3
R 1 If Column 3 says "YES" for the material, do an external wash to
R remove the material from the external surfaces of the engine that
R had chemical contact with the material. Use this procedure :
R - Use Cleaning of Electrical Harnesses and Contact Points (SPOP 6)
R to clean electrical harnesses and contact points (Ref. 70-00-00,
R P. Block 201).
R - Use Cleaning the Exterior of the Engine (SPOP 1) to clean other
R external surfaces (Ref. 70-00-00, P. Block 201).
R 2 If Column 3 says "NO" for the material, do not do an external wash.
R 3 If Column 3 says "N/R" for the material, it is not required (that
R is, it is permitted, but not necessary) to do an external wash to
R remove the material from the external surfaces.
R (c)Internal Wash - (Ref. Fig. 225), Column 4
R 1 If Column 4 says "YES" for the material, do an internal (gaspath)
R wash of the engine to remove the material from the engine gaspath
R surfaces. Refer to the applicable AMM maintenance task for the
R gaspath wash procedures.
R CAUTION : IF YOU OPERATE THE ENGINE AFTER ENGINE GASPATH PARTS
R COME IN CONTACT WITH THE MATERIAL, THE MATERIAL COULD
R CAUSE DAMAGE TO THESE PARTS AT ENGINE OPERATION
R TEMPERATURES.
R 2 If Column 4 says "NO" for the material, it is not permitted
R to do an internal (gaspath) wash. Do not operate the engine after
R engine gaspath parts come in contact with the material.
R NOTE : It is not possible to fully remove foam fire extinguisher
R agents from the engine gaspath by an internal wash (with
R plain water or with detergent).
R NOTE : Dry chemical fire extinguisher agents are not water soluble.
R Thus, an internal wash will cause these materials to cake,
R bond to engine parts, and/or causes air holes and cavities
R to become clogged.
R - If you or some other operator does an internal wash after engine
R gaspath parts come in contact with the material, then it will be
R necessary to remove and clean all parts in the engine gaspath.
R 3 If Column 4 says "N/R" for the material, it is not required
R (that is, it is permitted, but not necessary) to do an internal
R (gaspath) wash to remove the material from engine gaspath surfaces.
R (d)Disassemble/Clean By Engine Manual - (Ref. Fig. 225), Column 5
R 1 If Column 5 says "YES" for the material, disassemble the engine
R to clean the parts that have contamination. Use the subsequent
R procedure :

R CAUTION : IF YOU OPERATE THE ENGINE AFTER ENGINE GASPATH PARTS
R COME IN CONTACT WITH THE MATERIAL, THE MATERIAL COULD
R CAUSE DAMAGE TO THESE PARTS AT ENGINE OPERATION
R TEMPERATURES
R - Do not operate the engine after the engine has chemical contact
R with the material.
R - Complete this procedure as soon as possible after the parts have
R chemical contact with the material.
R - For gaseous fire extinguisher agents or vaporizing liquid fire
R extinguisher agents, disassemble the engine to remove all parts
R in the engine gaspath.
R - For foam fire extinguisher agents or dry chemical fire extin-
R guisher agents, disassemble the engine to remove those parts on
R which the visual/borescope inspection found contamination.
R . If you or some other operator did a gaspath wash after the
R material went into the engine, then it is necessary to remove
R and clean all parts in the engine gaspath.
R - Use the applicable AMM maintenance task for instructions to
R clean the parts.
R - After the parts are clean, do a visual inspection of all parts
R that had chemical contact. Use the applicable AMM maintenance
R task for inspection limits.
R 2 If Column 5 says "N/R" for the material, it is not required
R (that is, it is permitted, but not necessary) to disassemble
R the engine to clean the parts.

R D. Cleaning After a Hydraulic Fluid Leak
R (1)After a hydraulic fluid leak, do the subsequent procedure :
R (a)Complete this procedure as soon as possible after contamination
R from hydraulic fluid occurs.
R (b)Do a visual inspection of the external surfaces of the engine to
R see which parts have contamination from hydraulic fluid.
R 1 If external surfaces show baked-on or burned hydraulic fluid,
R contact the local Pratt & Whitney representative for the applicable
R requirements and procedures.
R 2 If external surfaces show wet hydraulic fluid with no indication
R of baked-on or burned hydraulic fluid, then do the subsequent steps
R in this procedure.
R (c)If the visual inspection of the external surfaces of the engine
R finds indications that hydraulic fluid went into the engine through
R bleed valves, the inlet, or the exhaust, then do an internal
R borescope inspection to see which parts have contamination from the
R hydraulic fluid.
R NOTE : This inspection will show how much of the engine you must
R disassemble to remove the parts have contamination from the
R hydraulic fluid.
R 1 If gaspath surfaces show contamination from hydraulic fluid, then
R it is necessary to remove the parts that have contamination from the
R hydraulic fluid for better cleaning.
R 2 It is not permitted to do an internal wash to remove hydraulic
R fluid from the gaspath surfaces.

this procedure.
(d)If the visual inspection of the external surfaces of the engine found wet hydraulic fluid with no indication of baked-on or burned hydraulic fluid, then do an external wash to remove the hydraulic fluid from the external surfaces of the engine. Use the subsequent procedure :
1 Use Cleaning of Electrical Harnesses and Contact Points (SPOP 6) to clean electrical harnesses and contact points (Ref. 70-00-00, P. Block 201).
2 Use one of the procedures in the subsequent list to clean other external surfaces :
- Use Cleaning the Exterior of the Engine (SPOP 1) to clean other external surfaces (Ref. 70-00-00, P. Block 201).
- Use Degrease Engine Parts by Solvent Wipe (SPOP 208) to remove grease from other external surfaces (Ref. 70-00-00, P. Block 201).
3 After the above steps, do a visual inspection to look for remaining hydraulic fluid varnish or baked-on hydraulic fluid.
(e)If the visual inspection after the external wash finds remaining hydraulic fluid varnish or baked-on hydraulic fluid, then do the subsequent procedure :
1 Disassemble the engine to remove those parts that show remaining hydraulic fluid varnish or baked-on hydraulic fluid.
2 Use the applicable AMM maintenance task instructions to clean the parts that show remaining hydraulic fluid varnish or baked-on hydraulic fluid.
3 After the parts are clean, do a visual inspection of the parts. Use the applicable AMM maintenance task for the inspection limits.
(f)If inspection finds part surfaces with baked-on or burned hydraulic fluid and/or engine gaspath surfaces with contaminations from hydraulic fluid, then do the subsequent procedure :
1 Do not operate the engine if engine gaspath surfaces have contamination from hydraulic fluid.
2 Disassemble the engine to remove those gaspath parts on which the visual/borescope inspection found contamination from hydraulic fluid.
- If you or some other operator did a gaspath wash after the contamination of engine gaspath surfaces from hydraulic fluid occured, then it is necessary to remove and clean all parts in the engine gaspath.
3 Use the applicable AMM maintenance task instructions to clean the parts.
4 After the parts are clean, do a visual inspection of all parts that had contamination from hydraulic fluid. Use the applicable AMM maintenance task for the inspection limits.

E. Cleaning After an Oil or Fuel Leak
(1)After an oil or fuel leak, do the subsequent procedure :
(a)Do an external wash to remove the oil or fuel from the external surfaces of the engine. Do the subsequent steps :
1 Use Cleaning of Electrical Harnesses and Contact Points (SPOP 6) to clean electrical harnesses and contact points (Ref. 70-00-00,

R P. Block 201).
R 2 Use one of the procedures in the subsequent list to clean other
R external surfaces :
R - Use Cleaning the Exterior of the Engine (SPOP 1) to clean other
R external surfaces (Ref. 70-00-00, P. Block 201).
R - Use Degrease Engine Parts by Solvent Wipe (SPOP 208) to remove
R grease from other external surfaces (Ref. 70-00-00, P. Block 201).
R (b)Do an internal (gaspath) wash of the engine to remove the oil or fuel
R from the engine gaspath surfaces. Refer to the applicable AMM
R maintenance task for the gaspath wash procedure.

R 36.(SPOP 426) Assembly And Installation of Fittings, Tubes, Manifolds, And Ducts

A. (SPOP 426) Installation of Tubes With Fixed (Brazed) Conical Seat Ferrules (37 Degree)

(1)Equipment and materials

ITEM	DESIGNATION
R (a)	Torque Wrench (As specified by the specific AMM maintenance task)
R (b)	Oil or Lubricant (As specified by the specific AMM maintenance task)

(2)Procedure - Method A - Typical installation of tubes (1) with fixed
R (brazed) conical seat ferrules (37 degree) (Ref. Fig. 226)
(a)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
(b)Remove all the protective covers from the tube (1) and mating adapters.
(c)Wipe clean the conical seats of the tube (1) and mating adapters.
(d)Examine the conical seats of the tube (1) and the mating adapters for any damage (such as, nicks, burrs, or wear). Replace, as necessary.
(e)Apply the necessary lubricant to the tube nut (2) threads and to the rear of the tube ferrules (nut loading surface).
(f)Remove any excess lubricant from the tube (1) threads and the conical seat areas.
(g)Install the tube (1) to the mating adapters and tighten the tube nuts (2) handtight only.
NOTE : Make sure that the tube nuts are handtight and that the tube conical seat is fully against the adapter conical seat. To make sure, you can tighten the nut with a wrench until you feel the seats contact and then loosen the nut 1/4 turn.
(h)Make sure the tube (1) is not bent and that the tube ends align with the mating adapters.
(j)Apply the necessary lubricant to the bolt (3) threads which attach the tube clamps (4).
(k)Attach all the clamps (4) and clamp bolts (3) handtight only.
(l)Make sure the installation of the clamps (4) and clamp bolts (3) do not stress or load the tube (1).
NOTE : When you install and torque clamp bolts (3) before the tube nuts (2), the tube (1) can turn on the conical seats to better align itself. This will put the tube (1) in the final position

FIRE EXTINGUISHER AGENT TYPE	VISUAL/ BORESCOPE INSPECTION	EXTERNAL WASH	INTERNAL WASH	DISASSEMBLE/ CLEAN BY ENGINE MANUAL
WATER				
WATER	N/R	N/R	N/R	N/R
WATER FOG	N/R	N/R	N/R	N/R
GASEOUS				
ANSUL INERGEN® (N2 + Ar + CO2)	N/R	N/R	N/R	N/R
CARBON DIOXIDE	N/R	N/R	N/R	N/R
NITROGEN	N/R	N/R	N/R	N/R
SULFUR HEXAFLUORIDE (SF6)	N/R	NO	NO	YES
VAPORIZING LIQUID				
DUPONT FE-232™ (HCFC-123)	N/R	NO	NO	YES
DUPONT FE-36™ (HFC-236fa)	N/R	NO	NO	YES
DUPONT FE-227™ /FM-200® (HFC-227 ea)	N/R	NO	NO	YES
GREAT LAKES FM-100 (HBFC-22B1)	N/R	N/R	N/R	N/R
HALON 1011 (HBCC-30B1)	N/R	NO	NO	YES
HALON 1202 (BFC-12B2)	N/R	NO	NO	YES
HALON 1211 (BCFC-12B1)	N/R	NO	NO	YES
HALON 1301 (BFC-13B1) - NACELLE DISCHARGE/RELEASE	N/R	N/R	N/R	N/R
HALON 1301 (BFC-13B1) - IN PRIMARY GASPATH	N/R	NO	NO	YES
HALON 2402 (BFC-114B2)	N/R	NO	NO	YES
HALOTRON® I (HCFC-123 BLEND)	N/R	NO	NO	YES
HALOTRON® II (HFC-134a + HFC-125 + CO_2)	N/R	NO	NO	YES
DRY CHEMICAL				
NFPA ABC MULTI-CLASS:				
AMMONIUM PHOSPHATE	YES	NO	NO	YES
NFPA BC MULTI-CLASS:				
PURPLE K	YES	NO	NO	YES
SODIUM BICARBONATE	YES	NO	NO	YES
NFPA CLASS D:				
FOUNDRY FLUX	YES	NO	NO	YES
ANSUL MET-L-X®	YES	NO	NO	YES
FYR-FYTER METAL FYR	YES	NO	NO	YES
M-1	YES	NO	NO	YES
PYRO-CHEM® G-1	YES	NO	NO	YES
Refer to the text for the full requirements.				

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Cleaning Requirements After Chemical Contact With Hydraulic Fluid, Fire Extinguishing Agents, Oil, or Fuel (Sheet 1/2)
Figure 225

R

FIRE EXTINGUISHER AGENT TYPE	VISUAL/ BORESCOPE INSPECTION	EXTERNAL WASH	INTERNAL WASH	DISASSEMBLE/ CLEAN BY ENGINE MANUAL
FOAM				
AQUEOUS FILM-FORMING FOAMS (AFFF):				
ANSULITE® 1%	N/R	N/R	N/R	N/R
ANSULITE® 3% (AFC-3A)	N/R	N/R	N/R	N/R
ANSULITE® PREMIUM 3% (AFC-5-A)	N/R	N/R	N/R	N/R
CHEMGUARD 3% AFFF C-303	N/R	N/R	N/R	N/R
ALL OTHER AQUEOUS FILM-FORMING FOAMS	YES	NO	NO	YES
HIGH EXPANSION FOAMS:				
ANSUL JET-X® 2 3/4%	N/R	N/R	N/R	N/R
NATIONAL FOAM HI-EX® 2%	N/R	N/R	N/R	N/R
ALL OTHER HIGH EXPANSION FOAMS	YES	NO	NO	YES
OTHER FOAM TYPES:				
PROTEIN (P, FP, OR FFFP)	YES	NO	NO	YES
SODA-ACID	YES	NO	NO	YES
TRIMETHOXYBOROXINE (TMB)	YES	NO	NO	YES
WATER-GLYCOL	YES	NO	NO	YES
Refer to the text for the full requirements.				

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Cleaning Requirements After Chemical Contact With Hydraulic Fluid, Fire Extinguishing Agents, Oil, or Fuel (Sheet 2/2)
Figure 225

R

before you tighten the tube nuts (2) and will decrease any stress on the tube (1) adjacent to the ferrules.

(m)Torque the clamp bolts (3) to the correct torque while you make sure the clamps (4) do not turn, twist, or bend.

(n)While you hold the mating adapter with a wrench, torque the tube nut (2) at each end to the necessary torque. Refer to Standard Torques (Ref. 70-00-00, P. Block 201).

R (p)Examine the tube (1) ends for any evidence of tube twist or damage adjacent to the brazed ferrules. Replace, as necessary.

R (q)Safety the tube nuts (2), where necessary.

B. (SPOP 426) Installation of Hose and/or Tube Assemblies With Fixed or Loose Flange Ends (Used With Packings or Seal Plates)

(1)Equipment and materials

ITEM		DESIGNATION
R	(a)	Torque Wrench (As specified by the specific AMM maintenance task)
R	(b)	Oil or Lubricant (As specified by the specific AMM maintenance task)

(2)Procedure - Method B - Typical installation of hose and/or tube assemblies (10) with fixed or loose flange ends (used with packings or

R seal plates (Ref. Fig. 227)

CAUTION : MAKE SURE THAT YOU REMOVE ANY PROTECTIVE COVERS FROM INSIDE THE TUBE OPENINGS. THESE TYPES OF COVERS HAVE CAUSED IN-FLIGHT SHUTDOWNS WHEN ACCIDENTALLY LEFT INSTALLED.

CAUTION : BE CAREFUL WITH ALL TUBES THAT CONTAIN A FLEX DESIGN SEGMENT. BE SURE TO REMOVE AND INSTALL A TUBE WITH A FLEX SEGMENT WITH THE SAME PRECAUTIONS USED FOR A TUBE WITHOUT A FLEX SEGMENT. DO NOT BEND THE FLEXHOSE OF A TUBE TO HELP WITH THE REMOVAL OR INSTALLATION OF AN ATTACHED COMPONENT. IF YOU BEND A FLEX SEGMENT TOO MUCH, YOU CAN CAUSE A KINK IN THE EXTERNAL WIREBRAID AND IN THE INNER POLYTETRAFLUOROETHYLENE (PTFE) TUBE AND THE TUBE COULD BREAK OR HAVE LEAKS. A FLEXHOSE KINK CAN CAUSE A LARGE DECREASE IN FATIGUE STRENGTH. LOW FATIGUE STRENGTH CAN CAUSE THE WIRES IN THE WIREBRAID TO BREAK DURING SUBSEQUENT ENGINE OPERATION.

NOTE : A flexhose kink is the result of movement of the flexhose to the point where the shape of the stainless steel wirebraid and the inner PTFE tube changes permanently from cylindrical to oval in one or more locations.

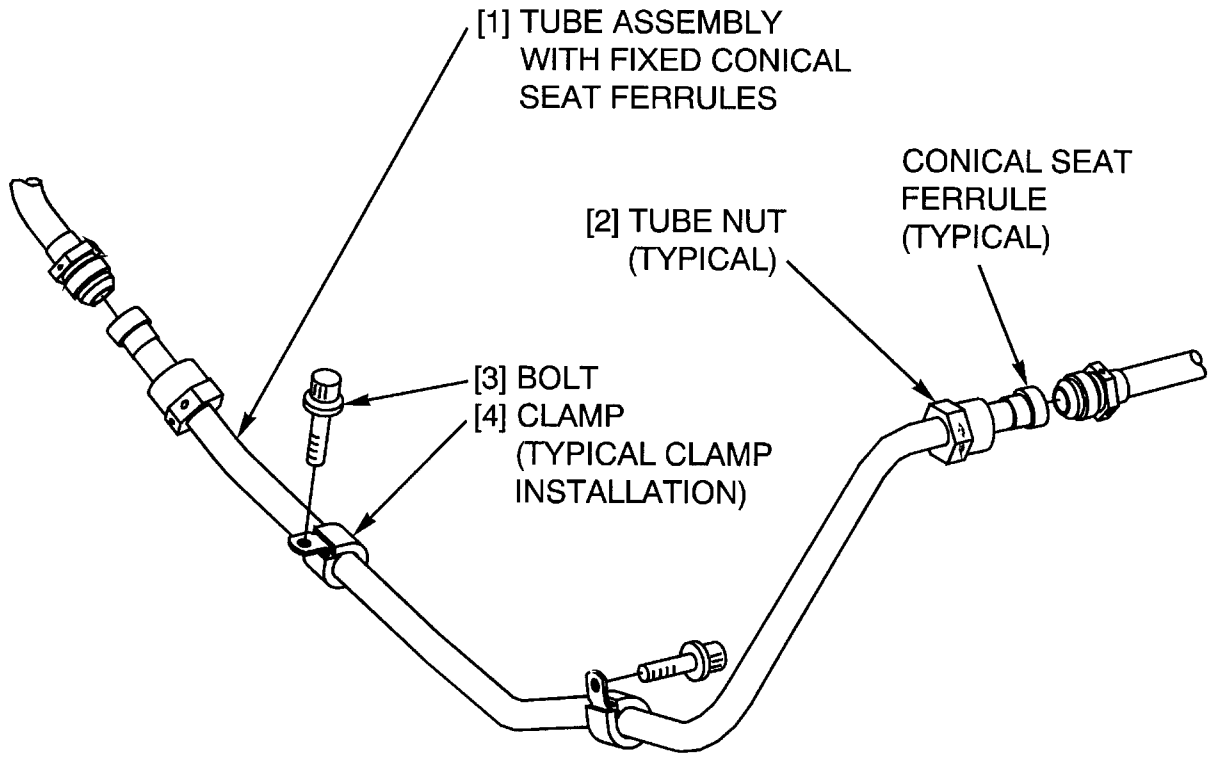
(a)Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(b)Remove all the protective covers from the tube (10) and mating adapters.

(c)Wipe clean the flange seats of the tube (10) and mating adapters.

(d)Examine the flange seats of the tube (10) and the mating adapters for any damage (such as, nicks, burrs, or wear). Replace, as necessary.

(e)Apply the necessary lubricant to the bolt (13), (17) threads which


[1] TUBE ASSEMBLY WITH FIXED CONICAL SEAT FERRULES
CONICAL SEAT FERRULE (TYPICAL)
[2] TUBE NUT (TYPICAL)
[3] BOLT
[4] CLAMP (TYPICAL CLAMP INSTALLATION)

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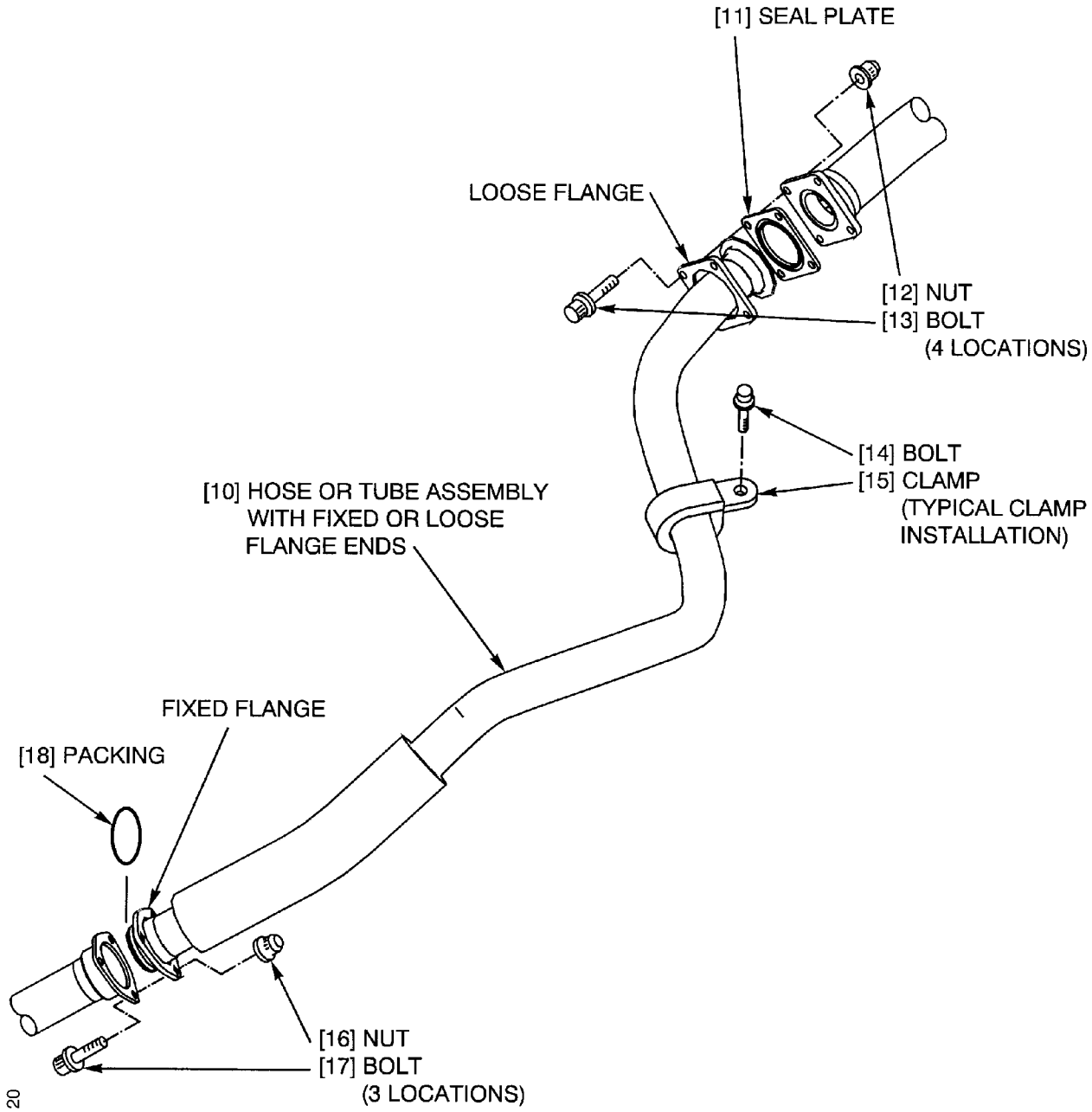
Installation of Tubes With Fixed (Brazed) Conical Seat Ferrules (37 Degree)
Figure 226

attach the tube flanges.
(f)Install any necessary packings (18) lubricated with the applicable lubricant.
(g)Carefully install the tube (10) and seal plates (11) to the mating adapters with the bolts (13) and nuts (12) handtight only.
(h)If applicable, make sure the packing (18) engaged the mating adapter fully without damage.
(j)Tighten the bolts (13), (17) and nuts (12), (16) at each end and loosen two turns.
(k)Apply the necessary lubricant to the bolt (14) threads which attach the tube clamps (15).
(l)Attach all the clamps (15) and clamp bolts (14) and tighten the clamp bolts (14) handtight only.
(m)Make sure the installation of the clamps (15) and clamp bolts (14) does not stress or load the tube (10).
NOTE : When you install and torque clamp bolts (14) before the bolts (13), (17) and nuts (12), (16) at each end of the tube (10), the tube (10) can turn on the seats to better align itself. This will put the tube in final position before you tighten the tube bolts (13), (17) and nuts (12), (16) and will decrease any stress on the tube adjacent to the ferrules.
(n)Torque the clamp bolts (14) to the correct torque while you make sure the clamps (15) do not turn, twist, or bend.
(p)Torque the bolts (13), (17) and nuts (12), (16) at each end to the necessary torque. Refer to Standard Torques (Ref. 70-00-00, P. Block 201).
(q)Examine the tube (10) for any tube damage or incorrect assembly. Replace as necessary.

C. (SPOP 426) Installation of Tubes With Bolted Flanges (Used With Crush-Type Gaskets)
(1)Equipment and materials

	ITEM	DESIGNATION
R	(a)	Torque Wrench (As specified by the specific AMM maintenance task)
R	(b)	Oil or Lubricant (As specified by the specific AMM maintenance task)

(2)Procedure - Method C - Typical installation of tubes (20) with bolted
R flanges (used with crush-type gaskets) (Ref. Fig. 228)
CAUTION : MAKE SURE THAT YOU REMOVE ANY PROTECTIVE COVERS FROM INSIDE THE TUBE OPENINGS. THESE TYPES OF COVERS HAVE CAUSED IN-FLIGHT SHUTDOWNS WHEN ACCIDENTALLY LEFT INSTALLED.
(a)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
(b)Remove all the protective covers from the tube (20) and mating bosses.
(c)Wipe clean the flange seats of the tube (20) and mating bosses.
(d)Examine the flange seats of the tube (20) and the mating bosses for



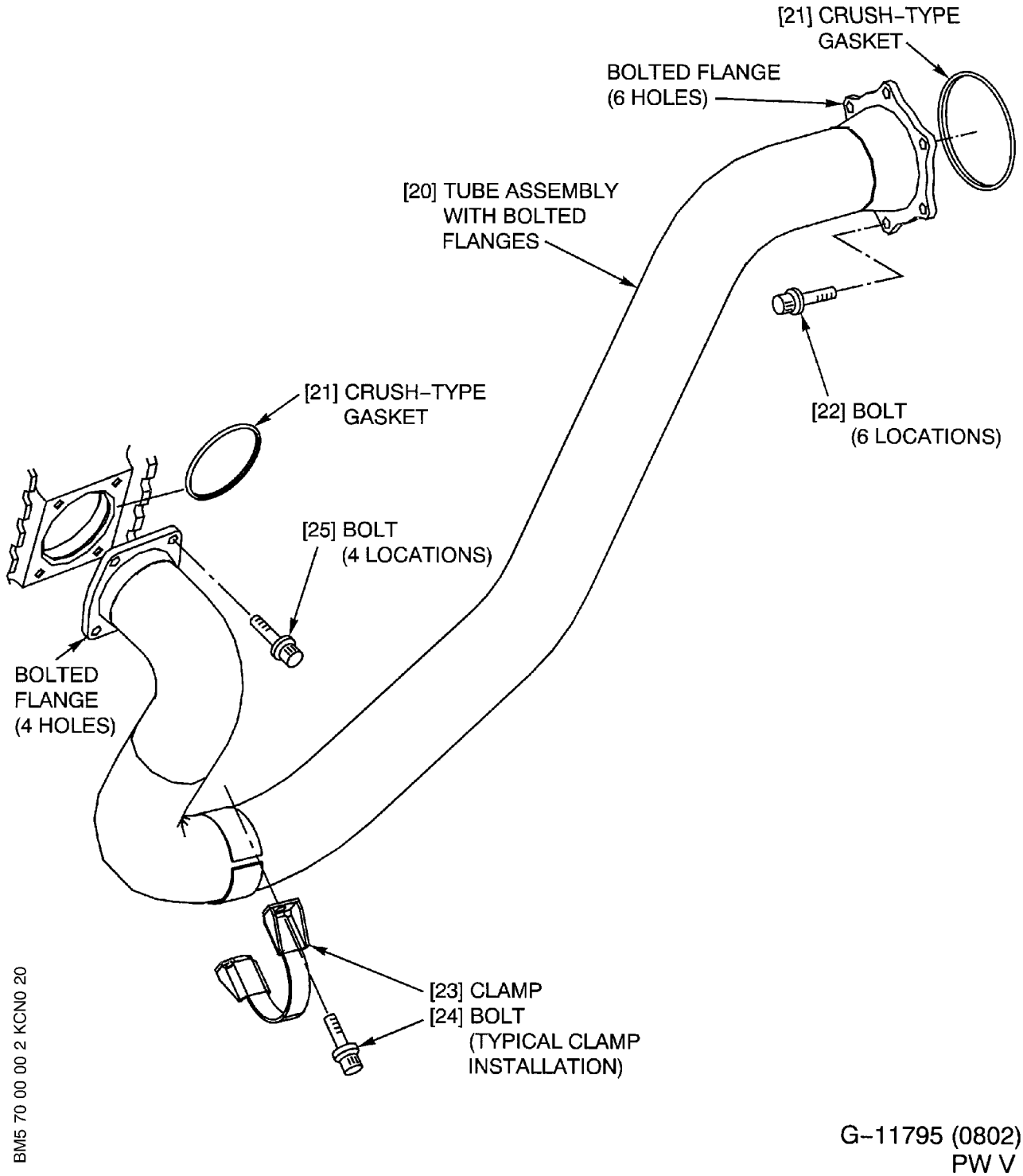
Installation of Hose and/or Tube Assemblies With Fixed or Loose Flange Ends (Used With Packings or Seal Plates)
Figure 227

any burrs or damage. Replace, as necessary.
(e)Apply the necessary lubricant to the bolt (22), (25) threads which attach the tube flanges.
(f)Install the necessary new gaskets (21) to the gasket groove in the tube (20) or mating boss flange. Use a small amount of Beeswax or Paraffin Wax Blend to hold in position.
(g)Carefully install the tube (20) to the mating bosses with the bolts (22), (25) handtight only.
(h)Apply the necessary lubricant to the bolt (23) threads which attach the tube clamps (24).
(j)Attach all the clamps (24) and clamp bolts (23) and tighten the clamp bolts (23) handtight only.
(k)Make sure the installation of the clamps (24) and clamp bolts (23) does not stress or load the tube (20).
(l)Torque the bolts (22), (25) at each end in small increments to the necessary torque; then, torque all the bolts (22), (25) again and until the same torque indication holds. Refer to Standard Torques (Ref. 70-00-00, P. Block 201).
(m)Torque the clamp bolts (23) to the correct torque while you make sure the clamps (24) do not turn, twist, or bend.
(n)Examine the tube (20) for any tube damage or incorrect assembly. Replace, as necessary.

D. (SPOP 426) Installation of Tubes With Flexible-Type Fittings (Used With Packings and Retainers)
(1)Equipment and materials

	ITEM	DESIGNATION
R	(a)	Torque Wrench (As specified by the specific AMM maintenance task)
R	(b)	Oil or Lubricant (As specified by the specific AMM maintenance task)

(2)Procedure - Method D - Typical installation of tubes (30) with flexible-
R type fittings (used with packings and retainers) (Ref. Fig. 229)
CAUTION : MAKE SURE THAT YOU REMOVE ANY PROTECTIVE COVERS FROM INSIDE THE TUBE OPENINGS. THESE TYPES OF COVERS HAVE CAUSED IN-FLIGHT SHUTDOWNS WHEN ACCIDENTALLY LEFT INSTALLED.
(a)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
(b)Remove all the protective covers from the tube (30) and mating adapters.
(c)Wipe clean the tube (30) ends and mating adapters.
(d)Examine the tube (30) ferrules, tube ends, and mating adapters for any burrs or damage. Replace, as necessary.
(e)Apply the necessary lubricant to the tube nut (35) threads.
(f)Remove any excess lubricant from the seal areas.
(g)Apply the necessary lubricant to the packings (34) and retainers (33).
CAUTION : BE SURE TO INSTALL A RETAINER WITH THE PACKING. IF THERE IS NO RETAINER, THE PACKING CAN PUSH OUT BETWEEN THE TUBE AND



Installation of Tubes With Bolted Flanges
(Used With Crush-Type Gaskets)
Figure 228

THE MATING ADAPTER. THIS CAN CAUSE PIECES OF PACKING MATERIAL TO GET INTO THE OIL OR FUEL SYSTEMS AND CAUSE ENGINE DAMAGE.

(h)Install the packing (34) and retainer (33) to each end of the tube against the ferrule (36).

NOTE : Some of these types of tubes (30) have loose (floating) ferrules (36). Make sure the ferrules are installed before you install the packings (34).

(j)Install the tube (30) to the mating adapters and tighten the tube nuts (35) handtight only.

(k)Make sure the tube (30) is not bent and that the tube ends align with the adapters.

(l)Apply the necessary lubricant to the bolt (31) threads which attach the tube clamps (32).

(m)Attach all the clamps (32) and clamp bolts (31) and tighten the clamp bolts handtight only.

(n)Make sure the installation of the clamps (32) and clamp bolts (31) does not stress or load the tube (30).

CAUTION : MAKE SURE YOU PUT THE PACKING AGAINST THE FERRULE (36) AND ALIGN THE TUBE (30) BEFORE YOU TORQUE THE TUBE NUTS (35). THIS PROCEDURE WILL PREVENT DAMAGE TO THE TUBE (30) AND/OR PACKING (34).

CAUTION : BE CAREFUL WHEN YOU TORQUE THE TUBE NUTS (35). USE THE APPLICABLE TORQUE TABLE FOR THE CORRECT LIMITS. TOO MUCH TORQUE CAN DAMAGE THE TUBE (30) AND/OR PACKING (34).

(p)Torque the tube nuts (35) to the necessary torque limit. Refer to Standard Torques (Ref. 70-00-00, P. Block 201).

NOTE : If the tube has a loose (floating) ferrule (36), torque the tube end with the loose ferrule (36) after you torque the end with the brazed ferrule.

(q)Loosen the tube nuts (35) one turn.

(r)Torque the tube nuts (35) again to the necessary torque limit. Refer to Standard Torques (Ref. 70-00-00, P. Block 201).

(s)Torque the clamp bolts (31) to the correct torque while you make sure the clamps (32) do not turn, twist, or bend.

(t)Examine the tube (30) ends for any evidence of tube twist or damage adjacent to the tube nuts (35). Replace, as necessary.

(u)Safety the tube nuts (35).

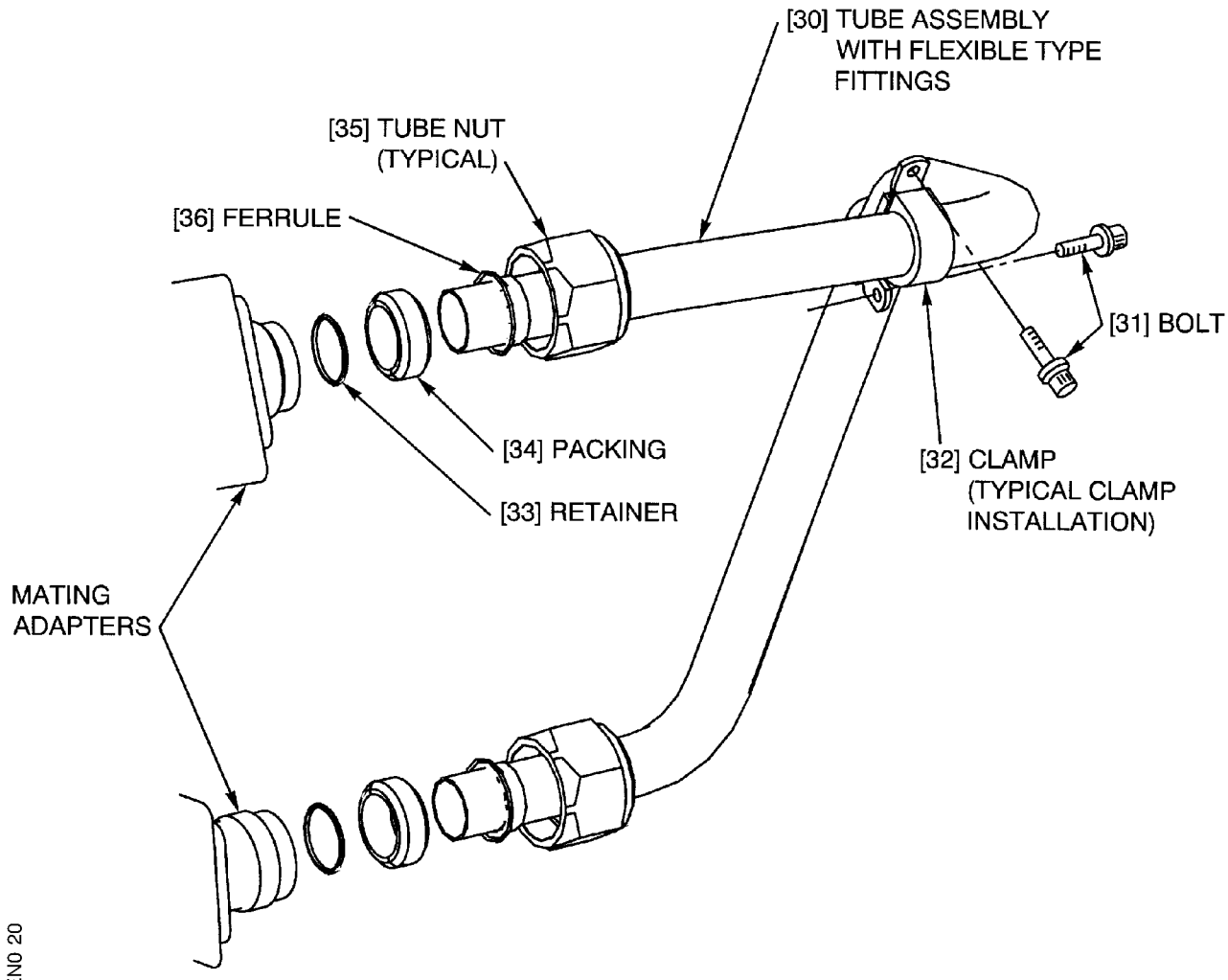
R 37.(SPOP 427) Application of Penetrating Oils

A. Equipment and Materials

ITEM	DESIGNATION
(1)Material No.P03-007	Oils (Ref. 70-00-00)
(2)Material No.P03-015	Oils (Ref. 70-00-00)
(3)Material No.P03-016	Oils (Ref. 70-00-00)
(4)Material No.P03-017	Oils (Ref. 70-00-00)

B. Procedure - Instructions

(1)Always obey the specific procedures and limits in the specific AMM main-



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Installation of Tubes With Flexible-Type Fittings
(Used With Packings and Retainers)
Figure 229

tenance tasks.

(2)Use penetrating oils or fluids to make the disassembly of parts easier.
tenance tasks.

(3)Apply one of these oils or fluids to the necessary area(s) :

NOTE : These oils and fluids are specifically for aluminum, magnesium, titanium, steel, nickel, single crystal, and cobalt alloy parts.

(a)Penetrating Oil (Material No.P03-007)

(b)Penetrating Fluid (Material No.P03-015)

(c)Penetrating Fluid (Material No.P03-016)

(d)Penetrating Oil (Material No.P03-017)

(4)After the disassembly, clean the remaining penetrating oil or fluid.
Refer to Degrease the Parts by Solvent Wipe (SPOP 428)
(Ref. 70-00-00, P. Block 201).

R 38.(SPOP 428) Preservation

A. (SPOP 428) General Instructions For the Preservation of Engines For Storage

(1)Reason for the job

(a)Use these general instructions to preserve in-service engines (on-wing and off-wing) and for new engines received from Pratt & Whitney. The engine can be installed on the aircraft, in a transport stand, or in a test cell.

(2)Equipment and materials

	ITEM	DESIGNATION
R	(a)	Caps
R	(b)	Other Covers
R	(c)	Plugs
R	(d)	Tarp
R	(e)	Plastic Sheeting
R	(f)Material No.P03-001	Oils (Ref. 70-00-00)
R	(g)Material No.P15-001	Storage Preservation (Ref. 70-00-00)

(3)General

(a)SPOP 428 contains four procedures.

1 (SPOP 428) General Instructions For the Preservation of Engines For Storage.

2 (SPOP 428) Preservation For 60 Days or Less (Method I).

3 (SPOP 428) Preservation For More Than 60 Days (Method II).

4 (SPOP 428) De-Preservation of the Engine After Storage.

(b)The procedures that follow are Pratt & Whitney guidelines only and represent what Pratt & Whitney has defined as "Best Practices" for the protection of out-of-service engines against damage from excessive exposure to moisture and debris and other environmental conditions during extended periods of no activity and/or storage.

(c)This SPOP 428 preservation procedure is offered as a guideline for each operator to use as a baseline to determine what precautions should be exercised to give sufficient protection to the engine based on that operator's experience with local environmental influences and past preservation practices. The engine preservation policy of any operator

should be a flexible program, implemented to give a maximum of protection to critical engine components (such as, gears, bearings, and accessory components), and which takes into consideration seasonal changes in local conditions (such as, temperature and humidity). Special care should be exercised in locations where exposure to severe temperature changes, severe humidity or salt water over extended periods of time could cause a higher risk of damage to engine parts.

(d) It is the responsibility of the engine operator to give sufficient protection for engines out of service for extended periods of time. It is also important that engines should not be preserved and put into storage and forgotten. Regular checks are necessary to be sure the preservation material and the internal environment is satisfactory. Engine preservation guidelines are for the use of operators to help start and implement a viable engine preservation plan.

(e) For those engines with an expired tag, transport the engine to a test cell or to an aircraft for a test run. Transport the engine by an approved method only to prevent damage to the engine. De-preservation of the engine must agree with the requirements specified in this SPOP.

(f) Use the applicable preservation procedure (Method I or Method II) that is necessary for the time that the engine will be in storage.

(g) If you are not sure as to the length of time that the engine will be in storage, use the Method II Preservation Procedure. Refer to Preservation of the Engine For More Than 60 Days (Method II).

(h) Engines can be left in storage (not active) with no preservation under the conditions which follow.

CAUTION : AFTER A MAXIMUM OF SEVEN DAYS AND THEN AT SEVEN-DAY INTERVALS (COUNT THE TIME FROM THE FIRST DAY OF NO ENGINE ACTIVITY), RUN THE ENGINE TO REMOVE ANY CONDENSATION IN THE OIL. IF YOU DO NOT THIS, YOU CAN CAUSE CONTAMINATION OF THE OIL SYSTEM AND CAUSE DAMAGE TO THE PARTS INSIDE THE OIL SYSTEM.

1 At every seven day interval, you must operate the engine (on-wing or in a test cell) to get the main oil temperature high enough to remove any moisture or condensation.

2 You must keep the engine inside or under cover as follows.
- Install a tarp or PVC plastic sheet over the inlet cowl.
- Install a tarp or PVC plastic sheet over the fan exhaust area.
- Install a tarp or PVC plastic sheet over the engine exhaust area.

3 The humidity must be at 60 percent or less.

4 There are no extreme temperature changes to cause condensation on and in the engine.

(4) New delivered engines

(a) When a new delivered engine is received from Pratt & Whitney, determine if you will operate the engine before the expiration of the 60-day limit (Method I) and do one of the steps that follow.

(b) If you plan to operate the engine within the 60-day limit of Method I, then additional preservation is not necessary.

(c) If you do not plan to operate the engine within the 60-day limit (Method I), do as follows before the expiration of the current preservation period.

1 Install Dehydrator (Desiccant) (Material No.P15-001) as follows.
- Open the engine covers.

CAUTION : DO NOT PUT THE DEHYDRATING AGENT (DESICCANT)(MATERIAL NO.P15-001) NEAR FAN OR TURBINE BLADES BECAUSE THE ROTATION OF THE BLADES CAN CAUSE THE DESICCANT BAGS TO TEAR.

- Put the specified amount of Dehydrating Agent (Desiccant)(Material No.P15-001) in the bottom of the engine bag or shipping container. Refer to the applicable AMM maintenance task for the amount.
- Put relative humidity indicators inside the inlet and exhaust areas.

2 Seal the engine for storage as follows.
- Install a tarp or PVC plastic sheet over the inlet cowl.
- Install a tarp or PVC plastic sheet over the fan exhaust area.
- Install a tarp or PVC plastic sheet over the engine exhaust area.
- The protective covers must have windows so that you can see the relative humidity indicators inside the engine.

3 Make a record of the engine preservation method and the date for each engine.

4 Examine the engine during preservation as follows.
- Every 15 days or less, examine the humidity indicators.
- If the relative humidity is less than 40 percent, change the dehydrating agent, if necessary. Permit the engine to continue in storage for 15 more days.
- If the relative humidity is more than 40 percent but less than 60 percent, replace the dehydrating agent and permit the engine to continue in storage for 15 more days.
- If the relative humidity is more than 60 percent, replace the dehydrating agent. If no lines in the fuel system were disconnected during the preservation period, re-preserve the oil system only. If the lines in the fuel system were disconnected during the preservation period, re-preserve both the fuel and oil systems. Refer to Preservation of the Engine For More Than 60 Days (Method II).

B. (SPOP 428) Preservation of the Engine For Storage For 60 Days or Less (Method I)

(1)Reason for the job

(a)Use these general instructions to preserve in-service engines (on-wing or off-wing) for a storage period of 60 days or less.

(b)You must obey the specific AMM maintenance task requirements in Preservation of the Engine for 60 Days or Less, (Method I) (Ref. 72-00-00, P. Block 301). Use this task for a general guideline only.

(c)The engine can be installed on the aircraft, in a transport stand, or in a test cell.

(2)Equipment and materials

	ITEM	DESIGNATION
R	(a)	Other Covers
R	(b)	Plugs
R	(c)	Tarp
R	(d)	Plastic Sheeting
R	(e)Material No.P03-001	Oils (Ref. 70-00-00)

Referenced Procedures

ITEM	DESIGNATION
- 12-13-79, P. Block 1	Engines
- 12-13-80, P. Block 1	Starting System
- 29-11-32, P. Block 401	Engine Pump - Removal/Installation
- 29-12-32, P. Block 401	Engine Pump 292030 - Removal/Installation
- 29-13-32, P. Block 401	Engine Pump 293031 - Removal/Installation
- 71-00-00, P. Block 201	Power Plant - General
- 72-00-00, P. Block 301	Engine General - Servicing

(3)Procedure - Preservation of the engine for 60 days or less (Method I)
(a)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
(b)Refer to the General Instructions For the Preservation of Engines For storage.
(c)Examine and clean any hydraulic fluid on the gearbox housing as follows.
CAUTION : DO NOT PERMIT THE HYDRAULIC FLUID TO STAY ON THE MAIN GEARBOX DURING THE PRESERVATION TIME. THE HYDRAULIC FLUID CAN CAUSE CORROSION AND DAMAGE TO THE GEARBOX HOUSING.
1 Examine the gearbox housing for hydraulic fluid on the gearbox housing.
2 Examine the hydraulic pump drive drain tube(s) for hydraulic fluid leakage.
- If you see any hydraulic fluid in the drain tube(s), remove the hydraulic pump(s) to examine and clean the drive pad areas. Refer to Remove the Hydraulic Pump(s) (Ref. 29-11-32, P. Block 401, 29-12-32, P. Block 401, 29-13-32, P. Block 401).
3 If you see any hydraulic fluid on the gearbox housing or drive pad, remove it by one of the methods which follow.
- Degrease the Engine Externals by Aqueous Cleaner (SPOP 1).
- Degrease the Engine Externals by Solvent Wipe (SPOP 208).
(d)Determine if you must flush, sample, or do nothing to the engine oil system. Refer to the Preservation Method Chart (Ref. Fig. 230).
(e)Flush (Ref. 12-13-79, P. Block 1) or sample (Ref. 12-13-79, P. Block 1) the engine oil system by the applicable AMM maintenance task.
NOTE : It is recommended to use a limit of 1000 ppm water per ASTM D6304-00 to determine if a mandatory oil flush in Method I can be avoided.
1 If the engine was operated within the last seven days, it is not necessary to flush or sample the engine oil system.
2 If you sample the engine oil by the ASTM D6304-00 procedure and the results are OK, it is not necessary to flush the oil system. This is for one 60 day period only (Ref. Fig. 230).
3 If you sample the engine oil by the ASTM D6304-00 procedure and the results are NOT OK, it is necessary to flush the oil system (Ref. Fig. 230).
(f)Drain the engine oil system by the applicable AMM maintenance task (Ref. 12-13-79, P. Block 1).
(g)Change the starter oil (Ref. 12-13-80, P. Block 1).

(h)If any accessories are removed from the main gearbox assembly, spray Engine Oil (Material No.P03-001) onto the gearbox drive pads.
(j)Install accessory gearbox covers on the gearbox.
(k)Seal the engine for storage as follows.
1 Install all necessary caps, plugs, and covers over all bleed valve openings, hoses, electrical connectors, and other openings.
2 You must keep the engine inside or under cover as follows.
- Install a tarp or PVC plastic sheet over the inlet cowl.
- Install a tarp or PVC plastic sheet over the fan exhaust area.
- Install a tarp or PVC plastic sheet over the engine exhaust area.

(l)Make a record of the engine preservation.
1 Record the preservation method and the preservation date for each engine.
(m)If the engine will stay in storage after the initial 60 days (Method I), you must do one of the options that follows (Ref. Fig. 230).
1 OPTION 1 : Preserve the engine by Method II that requires both the Oil System and Fuel System preservation.
2 OPTION 2 : Run (operate) the engine, as necessary, by the steps that follow :
NOTE : It is permitted to use OPTION 2 only when Method I is repeated a maximum of one time (that is, it may not be used if the engine will stay in storage more than 120 days).
a Remove protective covers.
b Service the oil system (Ref. 12-13-79, P. Block 1).
c Start the engine (Ref. 71-00-00, P. Block 201).
d Operate the engine at IDLE, as necessary, until the oil temperature is 220 deg.F (104.4 deg.C) or more. Continue to operate the engine for a minimum of five additional minutes.
e Do an engine shutdown (Ref. 71-00-00, P. Block 201).
f Make sure that the fuel is free of water. Refer to ASTM D4176 (Procedure 1) Visual Inspection Method. The fuel must be clear and bright by visual inspection standards.
g P&W recommends that you take two samples, one from the wing tank drain (before you start the engine) and one from the Fuel Filter Drain Plug on the Fuel Pump after the engine run. It is necessary to drain approximately 0.264 gallon (1 liter) of fuel for this sample testing.
h If the fuel sample fails the "clear and bright test", do as follows.
- If the fuel sample from the wing tank drain fails the "clear and bright test", take corrective action to remove the water from the wing tank ; continue to drain fuel until it is "clear and bright" by visual inspection standards.
- If the fuel sample from the Fuel Pump fails the "clear and bright test", run the engine again and sample the fuel again ; continue to run the engine and sample the fuel until the fuel is "clear and bright" by visual inspection standards.

NOTE : Loosen the Drain Plug from the Fuel Pump Filter Drain Port to permit removal of the sample without actual removal of the plug. This will prevent excessive drainage of fuels.

- Alternatively, you can preserve the fuel system as specified in Method II.

C. (SPOP 428) Preservation of the Engine For Storage For More Than 60 Days (Method II)

(1)Reason for the job

(a)Use these general instructions to preserve in-service engines (on-wing or off-wing) for a storage period of more than 60 days.

(b)You must obey the specific AMM maintenance task requirements in Preservation of the Engine for More Than 60 Days, (Method II) (Ref. 72-00-00, P. Block 301). Use this task for a general guideline only.

(c)The engine can be installed on the aircraft, in a transport stand, or in a test cell.

(2)Equipment and materials

	ITEM	DESIGNATION
R	(a)	Caps
R	(b)	Other Covers
R	(c)	Plugs
R	(d)	Tarp
R	(e)	Plastic Sheeting
R	(f)Material No.P03-001	Oils (Ref. 70-00-00)
R	(g)Material No.P03-002	Oils (Ref. 70-00-00)
R	(h)Material No.P15-001	Storage Preservation (Ref. 70-00-00)
R	Referenced Procedures	
	- 12-13-79, P. Block 1	Engines
	- 12-13-80, P. Block 1	Starting System
	- 29-11-32, P. Block 401	Engine Pump - Removal/Installation
	- 29-12-32, P. Block 401	Engine Pump 292030 - Removal/Installation
	- 29-13-32, P. Block 401	Engine Pump 293031 - Removal/Installation
	- 71-00-00, P. Block 501	Power Plant - General - Adjustment/Test
	- 72-00-00, P. Block 301	Engine General - Servicing

(3)Procedure - Preservation of the engine for more than 60 days (Method II)

(a)Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(b)Refer to the General Instructions For the Preservation of Engines For Storage.

(c)Preserve the engine oil system as follows.

1 If necessary, remove the protective covers from all the engine openings.

2 Drain the oil from the engine oil system and replace the oil filter element (Ref. 12-13-79, P. Block 1).

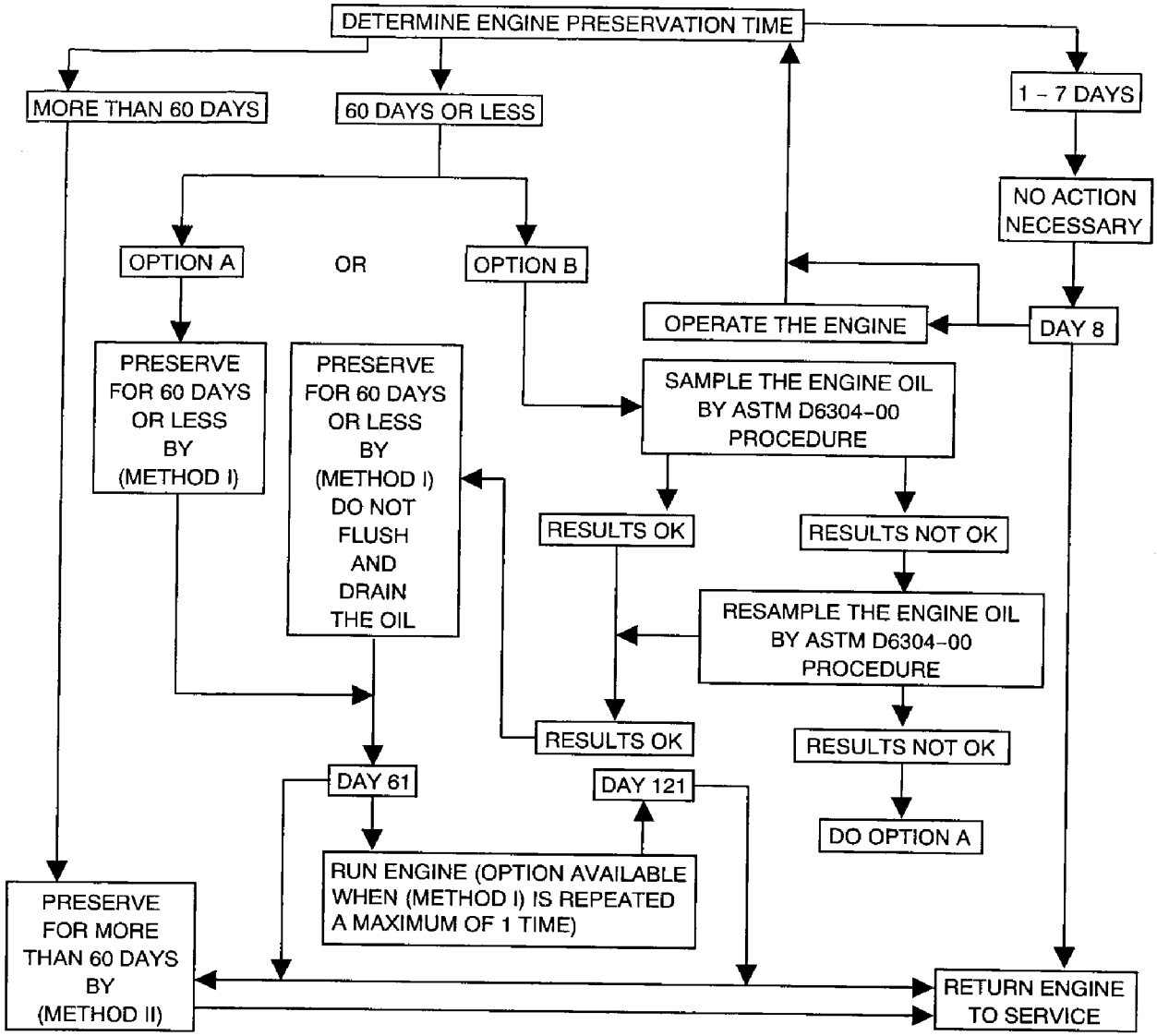
3 Fill the engine oil system (Ref. 12-13-79, P. Block 1).

4 Air motor the engine by Method A or B as follows.

a On-wing or test cell (Method A) :

- Dry motor the engine with the starter for three minutes or start the engine and run at idle (Ref. 71-00-00, P. Block 501).

NOTE : When you dry motor the engine, the fan (LPC) must turn. This is necessary to get oil through all of the engine oil


DETERMINE ENGINE PRESERVATION TIME
MORE THAN 60 DAYS
60 DAYS OR LESS
1 - 7 DAYS
NO ACTION NECESSARY
OPTION A
OR
OPTION B
OPERATE THE ENGINE
DAY 8
PRESERVE FOR 60 DAYS OR LESS BY (METHOD I)
PRESERVE FOR 60 DAYS OR LESS BY (METHOD I) DO NOT FLUSH AND DRAIN THE OIL
SAMPLE THE ENGINE OIL BY ASTM D6304-00 PROCEDURE
RESULTS OK
RESULTS NOT OK
RESAMPLE THE ENGINE OIL BY ASTM D6304-00 PROCEDURE
RESULTS OK
RESULTS NOT OK
DAY 61
DAY 121
DO OPTION A
RUN ENGINE (OPTION AVAILABLE WHEN (METHOD I) IS REPEATED A MAXIMUM OF 1 TIME)
PRESERVE FOR MORE THAN 60 DAYS BY (METHOD II)
RETURN ENGINE TO SERVICE

NOTES TO THE PRESERVATION CHART:

1. THIS CHART DOES NOT SPECIFY ALL THE STEPS BY SPOP 428 (REFER TO SPOP 428 FOR DETAILS).
2. SAMPLING OPTION IS RESTRICTED TO ONE 60 DAY PERIOD.
3. IN OPTION B, OIL SYSTEM FLUSH IS NOT NECESSARY (REF. METHOD I) IF SAMPLE TEST RESULTS ARE OK.
4. WHEN PRESERVING FOR MORE THAN 60 DAYS, FUEL SYSTEM PRESERVATION IS ALSO REQUIRED.
5. IF THE ENGINE WILL STAY IN STORAGE AFTER 60 DAYS (METHOD I), YOU CAN PRESERVE THE ENGINE AGAIN AFTER THE INITIAL 60-DAY PERIOD. SEE TEXT FOR INSTRUCTIONS.

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Preservation Method Chart
Figure 230

system.
- Do not drain the engine oil until after you preserve the fuel system.

b Dry motor the engine in the Transport Stand (Method B) :

NOTE : You can use this method for engine off-wing motoring when a test cell is not available.

- Remove the engine hydraulic pump (Ref. 29-11-32, P. Block 401, 29-12-32, P.Block 401, 29-13-32, P. Block 401).

CAUTION : MAKE SURE THAT THE ENGINE IS CORRECTLY INSTALLED IN THE STAND AND THE WHEELS OF THE STAND ARE LOCKED. TO PREVENT DAMAGE TO THE STARTER, DO NOT OPERATE THE STARTER FOR MORE THAN THE STARTER TIME LIMIT.

- Connect the external supply pressure source to before the starter air valve.

NOTE : You can use a standard aircraft pneumatic start cart and a locally manufactured coupling to connect the external supply pressure source to the starter air valve.

- If any of the accessories were removed from the main gearbox, make sure the pad covers and gaskets are installed. Put a cap on the pad cavity drains to prevent the loss of the engine oil.
- Make sure that no lines in the fuel and oil system were disconnected and/or removed.
  If necessary, connect and/or install lines by the instructions in the applicable AMM maintenance tasks.
- Use a wrench and extension to manually open the starter air valve.
- Dry motor the engine with the starter for three minutes. Refer to the applicable AMM maintenance task. If necessary, increase the starter inlet air pressure to turn the fan (LPC). The maximum starter inlet air pressure is 50 psi (344.7 kPa).

NOTE : When you dry motor the engine, the fan (LPC) must turn. This is necessary to get oil through all of the engine oil system. Be careful not to exceed the starter operation time limits.

WARNING : DO NOT TRY TO TURN THE FAN ROTOR BY HAND WITHOUT THE USE OF HEAVY PROTECTIVE GLOVES. MAKE SURE YOU HAVE SAFE, FIRM FOOTING. USE CARE TO PREVENT PERSONAL INJURY.

- Stop motoring the engine and permit the engine to come to a full stop.
- Do not drain the engine oil until after you preserve the fuel system.

(d)Preserve the fuel system as follows.

1 Connect the preservation hose to the engine fuel system.

NOTE : For specific details (Ref. 72-00-00, P. Block 301).

2 Preserve the fuel system with Lubricating Oil (Material No. P03-002).

3 Remove the fuel preservation hardware as follows.
- Disconnect the hose and drain the fuel system.
- Remove the applicable adapter from the fuel system.
- Remove the protection covers from the openings as necessary to prevent engine damage.

- Connect and install any disconnected or removed fuel system hardware.

(e)Drain the oil in the engine oil system (Ref. 12-13-79, P. Block 1).
(f)Change the starter oil (Ref. 12-13-80, P. Block 1).
(g)Examine, clean and preserve the gearbox as follows.

CAUTION : DO NOT PERMIT THE HYDRAULIC FLUID TO STAY ON THE MAIN GEARBOX DURING THE PRESERVATION TIME. THE HYDRAULIC FLUID CAN CAUSE CORROSION AND DAMAGE TO THE GEARBOX HOUSING.

1 Examine the gearbox housing for hydraulic fluid on the gearbox housing.
2 Examine the hydraulic pump drive drain tube(s) for hydraulic fluid leakage.
- If you see any hydraulic fluid in the drain tube(s), remove the hydraulic pump(s) to examine and clean the drive pad areas (Ref. 29-11-32, P. Block 401, 29-12-32, P. Block 401, 29-13-32, P. Block 401).

3 If you see any hydraulic fluid on the gearbox housing or drive pad, remove it by one of the methods which follow.
- Degrease the Engine Externals by Aqueous Cleaner (SPOP 1).
- Degrease the Engine Externals by Solvent Wipe (SPOP 208).

4 If any of the accessories are removed from the main gearbox housing, spray Engine Oil (Material No. P03-001) onto the gearbox drive pads.
5 Install accessory gearbox covers on the gearbox.

(h)Preserve the engine for relative humidity as follows.

NOTE : The relative humidity must be 40 percent or less inside the engine during the preservation time for optimal corrosion prevention.

1 Make sure that all the steps before this steps are done.
2 Install Dehydrator (Desiccant) (Material No. P15-001) as follows.
- Open the engine covers.
- Put the specified amount of dehydrating agent (desiccant) (Material No.P15-001) in the bottom of the engine bag or shipping container. Refer to the applicable AMM maintenance task for the amount.
- Put relative humidity indicators inside the inlet and exhaust areas.

3 Seal the engine for storage as follows.
- Install a tarp or PVC plastic sheet over the inlet cowl.
- Install a tarp or PVC plastic sheet over the fan exhaust area.
- Install a tarp or PVC plastic sheet over the engine exhaust area.
- The protective covers must have windows so that you can see the relative humidity indicators inside the engine.

4 Make a record of the engine preservation method and the date for each engine.

(j)Examine the engine during preservation as follows.
1 Every 15 days or less, examine the humidity indicators.
2 If the relative humidity is less than 40 percent, change the dehydrating agent, if necessary. Permit the engine to continue in storage for 15 more days.
3 If the relative humidity is more than 40 percent but less than

60 percent, replace the dehydrating agent and permit the engine to continue in storage for 15 more days.

4 If the relative humidity is more than 60 percent, replace the dehydrating agent. If no lines in the fuel system were disconnected during the preservation period, re-preserve the oil system only. If the lines in the fuel system were disconnected during the preservation period, re-preserve both the fuel and oil systems. Refer to Preservation of the Engine For More Than 60 Days (Method II) (SPOP 428).

D. (SPOP 428) De-Preservation of the Engine After Storage

(1)Reason for the job

(a)Use these general instructions to de-preserve in-service engines after storage.

(b)You must obey the specific AMM maintenance task requirements in De-Preservation of the Engine (Ref. 72-00-00, P. Block 301). Use this task for a general guideline only.

(2)Equipment and materials

ITEM	DESIGNATION
R (a)None	
Referenced Procedures	
- 12-13-79, P. Block 1	Engines
- 12-13-80, P. Block 1	Starting System
- 71-00-00, P. Block 201	Power Plant - General - Maintenance Practices
- 71-00-00, P. Block 501	Power Plant - General - Adjustment/Test
- 72-00-00, P. Block 301	Engine General - Servicing

(3)Procedure - De-Preservation of the engine

(a)Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(b)Remove the protective covers, if installed, from all the engine and gearbox openings.

(c)Remove the dehydrating agents and relative humidity indicators if installed.

(d)Examine and clean any hydraulic fluid on the gearbox housing as follows.

1 Examine the gearbox housing for hydraulic fluid on the gearbox housing.

2 If you see any hydraulic fluid on the gearbox housing or drive pad, remove it by one of the methods which follow.

- Degrease the Engine Externals by Aqueous Cleaner (SPOP 1).
- Degrease the Engine Externals by Solvent Wipe (SPOP 208).

3 Repair any hydraulic fluid leaks to prevent any further contamination.

(e)Install the engine to the test cell or to the aircraft.

(f)Fill and service the oil system, as necessary, with new oil (Ref. 12-13-79, P. Block 001).

(g)For engines preserved for more than 60 days (Method II), change the starter oil (Ref. 12-13-80, P. Block 1).

(h)For engines preserved for more than 60 days (Method II), de-preserve the fuel system as follows.
1 Wet motor the engine with the starter until fuel comes out of the exhaust. Refer to Engine Motor Leak Test (Wet Method) (Ref. 71-00-00, P. Block 501).
2 Start the engine and burn off the remaining flushing oil in the fuel system. Refer to Normal Engine Start Procedure (Ref. 71-00-00, P. Block 201).
3 Do the Idle Power Test. Refer to Idle Power Test (Ref. 71-00-00, P. Block 501).
4 Shut down the engine. Refer to Discontinued Start, Restart and Shutdown Procedures (Ref. 71-00-00, P. Block 201).
(j)For on-wing de-preservation, do the Replacement Engine Test (Ref. 71-00-00, P. Block 501).

R 39.(SPOP 429) Installation of Ball and Roller Bearings

A. Equipment and Materials

ITEM	DESIGNATION
(1)Material No.P03-001	Oils (Ref. 70-00-00)
(2)Material No.P03-019	Oils (Ref. 70-00-00)

B. Procedure - General Instructions
CAUTION : DO NOT TOUCH ENGINE BEARINGS WITH YOUR BARE HANDS. USE GLOVES TO PROTECT THE ENGINE BEARINGS. IF YOU DO NOT OBEY THIS CAUTION, DAMAGE TO THE BEARING CAN OCCUR.
(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
(2)Wear a clean pair of bearing gloves, made of an approved lint-free material when you handle bearings.
(3)When you assemble inner races of bearings on their mating shafts, expand the inner race with controlled heating.
(a)You can heat the inner race of demountable bearings and complete bearing assemblies of nondemountable bearings to the necessary temperature by immersion in a controlled hot oil bath, or with an oven or induction heater.
(b)Ckeck shafts and bearing races for size and trueness before heating to prevent abnormal fits.
(4)It is important to keep the area clean regardless of whether you use a hot oil bath, an oven, or an induction heater.
(5)Hot oil bath
(a)This used to be the typical heating method for bearings and other parts because of the anti-corrosion characteristics of oil. There are now environmental and safety concerns which make other methods a better choice.
(b)Be sure to put a cover on the tank to minimize contamination of the oil by airborne dirt and abrasives. It is important to change the oil and clean the tank regularly, as necessary.
(c)Do not permit bearings to rest on the bottom of the tank because the

settlings can cause contamination and the bearing temperature will be much greater than the indicated oil temperature. A heavy screen or series of rods that extend at least 3 in. (76.2 mm) above the tank bottom will keep the bearings surrounded by oil at an equal temperature and will permit any dirt to settle to the bottom of the tank.

(d)Use clean Engine Oil (Material No. P03-001) or Lubricating and Preservation Oil (Material No.P03-019) in the hot oil bath with a controlled temperature not be more than 250°F (121°C) unless specified differently in the specific AMM maintenance task.

(6)Oven

(a)An oven may not increase the temperature of the part as fast as an induction heater, but there is less potential to increase the temperature of the part too much. An oven gives an equal amount of heat to large or complex parts and thus minimizes distortion and thermal strees.

(b)A film of Engine Oil (Material No.P03-001) or Lubricating and Preservation Oil (Material No.P03-019) must be on each part before it goes into the oven. Engine Oil (Material No. P03-001) or Lubricating and Preservation Oil (Material No.P03-019) prevents corrosion before, during, and after assembly.

(c)The oven temperature must not be more than 250°F (121°C) unless specified differently in the specific AMM maintenance task.

(7)Induction heater

(a)A film of Engine Oil (Material No.P03-001) or Lubricating and Preservation Oil (Material No.P03-019) must be on each part before the induction heater is used to increase the temperature of the part. Engine Oil (Material No.P03-001) or Lubricating and Preservation Oil (Material No.P03-019) prevents corrosion before, during, and after assembly.

(b)An induction heater increases the temperature of a part quickly and does not have the environmental concerns of the hot oil bath, but to know how to get the correct temperature takes experience. Be sure to follow the manufacturer's instructions, warnings, and cautions.

1 PW has induction heater experience with units (Models TIH 020, TIH 050, TIH 100, and TIH 120) supplied by SKF Industries, units (Models 1x and 4x) supplied by Eddytherm and units (FOUCAULT 22 ESD Swing Arm (PWA 89127)) by Foucault International Corporation. Refer to the Supplier Source Code List (Ref. 70-00-00, P. Block 201).

Registered Trademark	Supplier Code
Eddyterm	C4298 and 75957
Foucault	EQ032
SKF	2M749

(c)Magnetism can be induced by induction heaters. Therefore, after induction heating, be sure to examine bearings for any remaining magnetism as follows.

1 Ball and roller bearings are at all times susceptible to magnetic adherence of small unwanted particles.

2 Limits for remaining magnetism are n2 gauss.
3 Demagnetize nonseparable bearings as assemblies. Slowly turn the inner and outer races in opposite directions when the bearing goes through the demagnetizer.
4 Demagnetize separable bearings one component at a time.
5 The components of a disassembled bearing must be kept together.
6 Remove bearing from the demagnetizer.

(d)There frequently is a degaussing feature built into the induction heater, but it may be inoperative (no indicating device to define if or when the degausser is functional or if there is a degausser feature).

(e)Bearing temperatures must not be more than 250°F (121°C) unless specified differently in the Engine Manual. Be sure to wear insulated, clean, lint-free gloves when you touch heated bearings.

C. Installation

(1)Handle the bearing as follows.
(a)Do not touch the bearing with your bare hands.
(b)Put clean gloves on your hands.
(c)Put the bearing on a piece of clean bearing paper.
(d)Separate the outer race from the inner race.
(e)For separable bearings, verify that the serial numbers on the inner and outer races are the same.

(2)Before you install the main bearings, wipe excess oil from the journals of the shaft, hub, or gear with a clean Lint-Free Cotton Cloth (Material No.P05-005) and apply a lubricant, as specified in the AMM maintenance task. Force must not be used in the assembly of parts. If there is any difficulty, disassemble parts and examine them for burrs or other interference.

(3)When a roller bearing is installed, turn the rollers with respect to the outer race. This will reduce the possibility of hang up of the rollers and will also increase the sensitivity of detection of the hang up.

(4)Manufacturer's number on bearing races must face the operator, as bearing is installed, unless specified differently in the specific AMM maintenance task.

(5)Large spannernuts used to secure main bearings or seals to shafts and housings frequently have small burrs at spanner slots. These burrs can cause damage to the bearing surfaces and cause incorrect torques. Deburr spannernuts with this condition.

R 40.(SPOP 430) Enhancement of Electrical Wiring Harness Contact Points

A. Equipment and Materials

ITEM	DESIGNATION
(1)Material No.P11-014A	Cleaning Agents (Ref. 70-00-00)
(2)Material No.P11-068	Cleaning Agents (Ref. 70-00-00)

R B. General
R (1)Electrical contact enhancer on connector contacts in connector

R interfaces decreases intermittent signals that you think are not
R correct, and/or nuisance messages.
R (2)This electrical contact enhancer is not an alternative to contact
R replacement. It is necessary to replace worn or damaged connectors as
R soon as the harness is at a location where it is possible to replace the
R connectors.

R C. Procedure - Cleaning Instructions
(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
R (2)Clean the connectors, if the connectors are not clean or dry. Refer to Cleaning of the Electrical Wiring Harnesses and Contact Points (SPOP 6) (Ref. 70-00-00, P. Block 201).
R (3)Apply one drop of Electrical Contact Enhancer (Material No. P11-068)
R to the brush that the manufacturer supplies with the electrical contact
R enhancer and then use the brush to apply a thin layer of the electrical
R contact enhancer to the electrical contact pins on the male connector of
R the mating pair of electrical connectors.
R NOTE : Do not apply Electrical Contact Enhancer (Material No. P11-068)
R to igniter high tension lead contacts, EGT harness connections,
R or EGT junction box connections. The temperature of these con-
R nections could increase to higher than 425°F (218°F) decomposi-
R tion temperature of Electrical Contact Enhancer
R (Material No. P11-068).
R (a)If the ambient temperature is too cold for the electrical contact
R enhancer to flow sufficiently, add Reagent Grade Isopropyl Alcohol
R (Material No. P11-014A) to the Electrical Contact Enhancer (Material
R No. P11-068) in a proportion of 4:1 maximum (that is, four parts or
R less isopropyl alcohol to one part electrical contact enhancer) to
R make the electrical contact enhancer more liquid.
R (b)If you added alcohol to the electrical contact enhancer, let the
R applied electrical contact enhancer on the connector dry for one hour
R minimum before you connect the connectors.
R (4)Connect the mating connectors. Refer to Installation of Electrical
R Harnesses, Leads, and Cables (Ref. 70-00-00, P. Block 201).

R 41.(SPOP 532) Denicking (Blending) and Buffing/Polishing of Titanium Parts

A. Equipment and Materials

ITEM	DESIGNATION
(1)	Pneumatic Hand Tool
(2)	Crocus Cloth
(3)	Tampico Brush
(4)	Abrasive Pads
(5)	Abrasive Paper
(6)	Abrasive Stone
(7)	Emery Cloth
(8)	Files
(9)	Silicon Carbide or Aluminum Oxide Grit (80, 120, or 180 mesh)

ITEM	DESIGNATION
(10)Material No.P05-066	Special Materials (Ref. 70-00-00)
(11)Material No.P05-353	Special Materials (Ref. 70-00-00)
(12)Material No.P05-354	Special Materials (Ref. 70-00-00)
(13)Material No.P05-384	Special Materials (Ref. 70-00-00)
(14)Material No.P05-421	Special Materials (Ref. 70-00-00)
(15)Material No.P05-422	Special Materials (Ref. 70-00-00)
(16)Material No.P05-426	Special Materials (Ref. 70-00-00)
(17)Material No.P05-427	Special Materials (Ref. 70-00-00)

B. Procedure - General Denicking and Buffing Instructions

WARNING : TITANIUM DUST CAN BE A FIRE HAZARD. BE SURE TO FREQUENTLY REMOVE BLEND DUST FROM THE PART, BLENDING AREA, AND GLOVES WORN DURING THE REPAIR.

CAUTION : LIMITS SPECIFIED IN THIS SECTION ARE FOR GENERAL USE ONLY. LIMITS SPECIFIED IN THE PART-SPECIFIC MANUALS TAKE PRECEDENCE. POST-BLEND SURFACE TREATMENT REQUIREMENTS WILL BE DETAILED WITHIN THE SPECIFIC BLEND REPAIR.

CAUTION : WHEN YOU DO THIS PROCEDURE, BE SURE TO USE GOOD SHOP PRACTICES AND COMMON SENSE. ABUSIVE BLENDING CAN CAUSE DAMAGE THAT IS HARMFUL TO THE LIFE AND FUNCTION OF THE REPAIRED PART.

CAUTION : TO CONTROL DUST AND NOISE CAUSED BY BLENDING, AND TO REDUCE THE RISK OF FIRE HAZARD FROM BLENDING DUST OF CERTAIN MATERIALS, WHENEVER POSSIBLE, DO THE BLENDING OPERATION IN A VENTILATED BOOTH. CONTACT YOUR LOCAL ENVIRONMENTAL HEALTH AND SAFETY PERSONNEL FOR SPECIFIC REQUIREMENTS.

CAUTION : USE ONLY MINIMUM PRESSURE WHEN YOU APPLY BLENDING TOOLS TO PARTS. EXCESSIVE PRESSURE AND SPEED WILL CAUSE SPARKS OR AN ORANGE PEEL EFFECT THAT CAN POSSIBLY BE HARMFUL TO THE PART. KEEP MATERIAL REMOVAL TO A MINIMUM. DO NOT EXCEED BLEND LIMITS.

CAUTION : CHECK THE PART FREQUENTLY FOR HEAT BUILD-UP. IF THE HEAT BUILD-UP IS TOO HOT TO TOUCH WITH YOUR HAND, LET THE PART TO DECREASE IN TEMPERATURE BEFORE YOU CONTINUE WITH THE REPAIR. OVERHEATING OF PARTS DURING BLENDING CAN CAUSE EMBRITTLEMENT.

CAUTION : DO NOT OVERHEAT THE PART BECAUSE DAMAGE CAN OCCUR.

CAUTION : BE SURE TO DRESS THE ABRASIVE TOOL BEFORE BLENDING TO GET THE BEST TOOL PERFORMANCE AND TO PREVENT MATERIAL CROSS-CONTAMINATION.

CAUTION : USE A SHIELD OR MASKING TO PROTECT OTHER SURFACES FROM DAMAGE BY ACCIDENTAL TOOL CONTACT DURING THE REPAIR.

(1)Blending general guidelines

(a)Blending is an operation that is used to remove nicks, scratches, high metal, and other surface irregularities by intentional removal of base metal. Manual or mechanical methods are used to produce shallow and smooth surface depressions that reduce the stress concentration from the damaged area by the distribution of the stress concentration over larger, more tolerant areas.

(b)Before you start any blend repair, make sure that the part is crack-free. Refer to Fluorescent Penetrant Inspection (Local

Application) (SPOP 70) (Ref. 70-00-00, P. Block 201).

(c) Non-toleranced enclosed areas defined in blend repairs are to corners, points of tangency between surfaces, or at points opposite one of these locations. Enclosed areas will assume a tolerance of plus 0.125 in. (3.175 mm) in all directions unless adjacent areas are specified as areas where blending is not permitted.

(d) It is better to blend sharp impact damage that is within acceptable limits than it is to accept that damage. The sharper the impact, the better it is to blend the damaged area.

(e) It is recommended that you make one single blend when the adjacent damage is so close together that the minimum length-to-depth blend ratio cannot be done independently.

(f) The depth of the blend must be as deep as necessary to remove the damage with the repair limits specified.

(g) The best blends are the ones which are smooth, continuous, and round-bottomed that extend outboard from the damage area as much as necessary. Refer to the step that follows.

(h) For rotating parts, the length of the blend must be a minimum of 15 times the maximum depth of the blend in all directions. For non-rotating parts, the length of the blend must be a minimum of 10 times the maximum depth of the blend in all directions.

R (j) For local damage in the form of raised material, manual blending (that is, blending by hand) is the preferred method. Refer to the manual blending steps.

R (k) When blending on a cylindrical surface, blend in the circumferential direction.

R (l) Blend engine radial members in a radial direction.

R (m) For parts that are smaller than 1.75 in. (44.45 mm) in length, the Manual Blending procedure that follows is recommended.

R (n) Manual blending (blending by hand)

1 Manual blending is done with abrasive stones, abrasive paper, abrasive pads, files, emery cloth, and/or crocus cloth.

NOTE : Blending can be done with more than one grade of abrasive (coarse to fine, as necessary) to remove damage and get the specified surface finish. Be sure to start with the least aggressive abrasive necessary to remove the damage.

R (p) Mechanical blending (Power blending)

CAUTION : DO NOT OVERHEAT THE PART OR DAMAGE CAN OCCUR.

1 When blending, use a power tool (electric or air) with abrasive-impregnated wheels, stones, and/or pads.

NOTE : Blending can be done with more than one grade or abrasive (coarse to fine, as necessary) to remove damage and get the specified surface finish. Be sure to start with the least aggressive abrasive necessary to remove the damage.

2 Use minimum pressure when you apply the blending tool to the part to prevent heat build-up. Do not let abrasive wheels to become loaded up with any particles remaining from blending.

(2) Visual inspection of the blends

(a) The surface finish of the blended area must be as smooth as, or smoother than, the initial surface. You can compare the surface finish with the adjacent non-blended surface.

(b)All transitions from blended to non-blended areas must be smooth and continuous.
(c)If the blended area intersects adjacent radii, the initial radius contour must be restored. Butterfly polish holes, as necessary.
(d)If the blended area intersects a corner, break the sharp edges 0.003 - 0.015 in. (0.08 - 0.38 mm).

(3)Buffing/Polishing (optional)
(a)Buffing is an optional operation that you can use to get the necessary surface finish while blending.
1 Buff reworked area(s) with a power tool, a tampico brush, and Polishing Buffing Compound (Material No.P05-066) or Silicon Carbide Deburring Compound (Material No.P05-384).
2 Use minimum pressure when you apply the buffing brush to the part to prevent heat build-up.
3 Buff engine radial members in a radial direction.
4 Buff cylindrical surfaces in a circumferential direction.
(b)Polishing is an optional operation that can be used to smooth minor scratches and burrs with fine grain abrasive paper, abrasive cloth, crocus cloth, emery cloth, or scrub pad (Material No.P05-421 or P05-422).

(4)Special instructions for the blending of rotating parts
CAUTION : WHEN YOU BLEND ROTATING COMPONENTS, DO THE PROCEDURE IN THE ORDER GIVEN IN THE PROCEDURE TO PREVENT DAMAGE TO THE PART.
NOTE : Be sure to follow all requirements in the Blending and Buffing/Polishing procedures above.
(a)In areas where shotpeening is required, on-wing blending is not permitted. Blend only as specified in the specific AMM maintenance task.
(b)Blend to a sufficient depth to remove all damage that you can see plus 0.002 to 0.003 in. (0.051 to 0.076 mm) of material within the repair limits specified.
(c)Blending must start with the coarser grades of resilient flexible abrasive impregnated wheels, brushes, or points for the initial removal of damage, but not coarser than is necessary to remove the damage.
(d)Finish blending the part with the finer grades of abrasive until the surface is as smooth as, or smoother than, the adjacent surfaces.
(e)Use grades of abrasives in the order that follows :
1 80 mesh silicon carbide or aluminum oxide grit
2 120 mesh silicon carbide or aluminum oxide grit
3 180 mesh silicon carbide or aluminum oxide grit
4 Optional : Use Polishing Compound (Material No.P05-354) or Polishing Compound (Material No.P05-426) or Polishing Compound (Material No.P05-427) with Cloth Wheel (Non-Coated) (Material No.P05-353) to get a surface finish, if necessary.

R 42. Denicking (Blending) and Buffing/Polishing of Steel, Nickel, Cobalt, Aluminum, and Magnesium Alloy Parts (SPOP 533)

A. Equipment and Materials

ITEM	DESIGNATION
(1)	Pneumatic Hand Tool
(2)	Crocus Cloth
(3)	Tampico Brush
(4)	Abrasive Pads
(5)	Abrasive Paper
(6)	Abrasive Stone
(7)	Emery Cloth
(8)	Files
(9)	Silicon Carbide or Aluminum Oxide Grit (80, 120, or 180 mesh)
(10)Material No.P05-066	Special Materials (Ref. 70-00-00)
(11)Material No.P05-353	Special Materials (Ref. 70-00-00)
(12)Material No.P05-354	Special Materials (Ref. 70-00-00)
(13)Material No.P05-384	Special Materials (Ref. 70-00-00)
(14)Material No.P05-421	Special Materials (Ref. 70-00-00)
(15)Material No.P05-422	Special Materials (Ref. 70-00-00)
(16)Material No.P05-426	Special Materials (Ref. 70-00-00)
(17)Material No.P05-427	Special Materials (Ref. 70-00-00)

B. Procedure - General Denicking and Buffing/Polishing Instructions

WARNING : MAGNESIUM DUST IS EXTREMELY FLAMMABLE. FOLLOW THE PRECAUTIONS VERY CAREFULLY TO PREVENT FIRE. BE SURE TO FREQUENTLY REMOVE BLEND DUST FROM THE PART, BLENDING AREA, AND GLOVES WORN DURING THE REPAIR.

CAUTION : LIMITS SPECIFIED IN THIS SECTION ARE FOR GENERAL USE ONLY. LIMITS SPECIFIED IN THE PART-SPECIFIC MANUALS TAKE PRECEDENCE. POST-BLEND SURFACE TREATMENT REQUIREMENTS WILL BE DETAILED WITHIN THE SPECIFIC BLEND REPAIR.

CAUTION : WHEN YOU DO THIS PROCEDURE, BE SURE TO USE GOOD SHOP PRACTICES AND COMMON SENSE. ABUSIVE BLENDING CAN CAUSE DAMAGE THAT IS HARMFUL TO THE LIFE AND FUNCTION OF THE REPAIRED PART.

CAUTION : TO CONTROL DUST AND NOISE CAUSED BY BLENDING, AND TO REDUCE THE RISK OF FIRE HAZARD FROM BLENDING DUST OF CERTAIN MATERIALS, WHENEVER POSSIBLE, DO THE BLENDING OPERATION IN A VENTILATED BOOTH. CONTACT YOUR LOCAL ENVIRONMENTAL HEALTH AND SAFETY PERSONNEL FOR SPECIFIC REQUIREMENTS.

CAUTION : USE ONLY MINIMUM PRESSURE WHEN YOU APPLY BLENDING TOOLS TO PARTS. EXCESSIVE PRESSURE AND SPEED WILL CAUSE SPARKS OR AN ORANGE PEEL EFFECT THAT CAN POSSIBLY BE HARMFUL TO THE PART. KEEP MATERIAL REMOVAL TO A MINIMUM. DO NOT EXCEED BLEND LIMITS.

CAUTION : CHECK THE PART FREQUENTLY FOR HEAT BUILD-UP. IF THE HEAT BUILD-UP IS TOO HOT TO TOUCH WITH YOUR HAND, LET THE PART TO DECREASE IN TEMPERATURE BEFORE YOU CONTINUE WITH THE REPAIR. OVERHEATING OF PARTS DURING BLENDING CAN CAUSE EMBRITTLEMENT.

CAUTION : DO NOT OVERHEAT THE PART BECAUSE DAMAGE CAN OCCUR.

CAUTION : BE SURE TO DRESS THE ABRASIVE TOOL BEFORE BLENDING TO GET THE BEST TOOL PERFORMANCE AND TO PREVENT MATERIAL CROSS-CONTAMINATION.

CAUTION : USE A SHIELD OR MASKING TO PROTECT OTHER SURFACES FROM DAMAGE BY ACCIDENTAL TOOL CONTACT DURING THE REPAIR.

(1)Blending general guidelines

(a)Blending is an operation that is used to remove nicks, scratches, high metal, and other surface irregularities by intentional removal of base metal. Manual or mechanical methods are used to make shallow and smooth surface depressions that reduce the stress concentration from the damaged area by the distribution of the stress concentration over larger, more tolerant areas.

(b)Before you start any blend repair, make sure that the part is crack-free. Refer to Fluorescent Penetrant Inspection (Local Application) (SPOP 70).

(c)Non-toleranced enclosed areas defined in blend repairs are to corners, points of tangency between surfaces, or at points opposite one of these locations. Enclosed areas will assume a tolerance of plus 0.125 in. (3.175 mm) in all directions unless adjacent areas are specified as areas where blending is not permitted.

(d)It is better to blend sharp impact damage that is within acceptable limits than it is to accept that damage. The sharper the impact, the better it is to blend the damaged area.

(e)It is recommended that you make one single blend when the adjacent damage is so close together that the minimum length-to-depth blend ratio cannot be done independently.

(f)The depth of the blend must be as deep as necessary to remove the damage with the repair limits specified.

(g)The best blends are the ones which are smooth, continuous, and round-bottomed that extend outboard from the damage area as much as necessary. Refer to the step that follows.

(h)For rotating parts, the length of the blend must be a minimum of 15 times the maximum depth of the blend in all directions. For non-rotating parts, the length of the blend must be a minimum of 10 times the maximum depth of the blend in all directions.

R (j)For local damage in the form of raised material, manual blending (that is, blending by hand) is the preferred method. Refer to the Manual Blending steps.

R (k)When blending on a cylindrical surface, blend in the circumferential direction.

R (l)Blend engine radial members in a radial direction.

R (m)For parts that are smaller than 1.75 in. (44.45 mm) in length, the Manual Blending procedure that follows is recommended.

R (n)Manual blending (blending by hand)

1 Manual blending is done with abrasive stones, abrasive paper, abrasive pads, files, emery cloth, and/or crocus cloth.

NOTE : Blending can be done with more than one grade of abrasive (coarse to fine, as necessary) to remove damage and get the specified surface finish. Be sure to start with the least aggressive abrasive necessary to remove the damage.

R (p)Mechanical blending (power blending)

CAUTION : DO NOT OVERHEAT THE PART OR DAMAGE CAN OCCUR.

1 When blending, use a power tool (electric or air) with abrasive-impregnated wheels, stones, and/or pads.

NOTE : Blending can be done with more than one grade of abrasive (coarse to fine, as necessary) to remove damage and get the specified surface finish. Be sure to start with the least aggressive abrasive necessary to remove the damage.

2 Use minimum pressure when you apply the blending tool to the part to prevent heat build-up. Do not let abrasive wheels to become loaded up with any particles remaining from blending.

(2)Visual inspection of the blends

(a)The surface finish of the blended area must be as smooth as, or smoother than, the initial surface. You can compare the surface finish with the adjacent non-blended surface.

(b)All transitions from blended to non-blended areas must be smooth and continuous.

(c)If the blended area intersects adjacent radii, the initial radius contour must be restored.

(d)If the blended area intersects a corner, break the sharp edges 0.003 - 0.015 in. (0.08 - 0.38 mm).

(3)Buffing/Polishing (optional)

(a)Buffing is an optional operation that you can use to get the necessary surface finish while blending.

1 Buff reworked area(s) with a power tool, a tampico brush, and Polishing Buffing Compound (Material No.P05-066) or Silicon Carbide Deburring Compound (Material No.P05-384).

2 Use minimum pressure when you apply the buffing brush to the part to prevent heat build-up.

3 Buff engine radial members in a radial direction.

4 Buff cylindrical surfaces in a circumferential direction.

(b)Polishing is an operation that can be used to smooth minor scratches and burrs with fine grain abrasive paper, abrasive cloth, crocus cloth, emery cloth, or scrub pad (Material No.P05-421 or P05-422).

(4)Local touch-up after blending

(a)Aluminum anodized parts - To prevent corrosion damage on aluminum anodized parts after blending, do a local touch-up of the repair. Refer to Anodize Touch-Up (SPOP 42).

(b)Nickel-cadmium plated or PWA 110 coated parts - Refer to the engine shop P&W Standard Practices Manual - SPOP 144 for disposition and repair.

NOTE : SPOP 144 is not a typical on-wing type repair. You must measure, mix, and apply chemicals and solutions that are not normally provisioned at line stations. Refer to the P&W Standard Practices Manual (PN 585005), 70-41-03.

(c)Magnesium parts with PWA 547 coating - Refer to the engine shop P&W Standard Practices Manual - SPOP 155 for disposition and repair.

NOTE : SPOP 155 is not a typical on-wing type repair. You must measure, mix, and apply chemicals and solutions that are not normally provisioned at line stations. Refer to the P&W Standard Practices Manual (PN 585005), 70-41-03.

(5)Special instructions for the blending of rotating parts

CAUTION : WHEN YOU BLEND ROTATING COMPONENTS, DO THE PROCEDURE IN THE ORDER GIVEN IN THE PROCEDURE TO PREVENT DAMAGE TO THE PART.

NOTE : Be sure to follow all requirements in the blending and buffing/

polishing procedures above.

(a)In areas where shotpeening is required, on-wing blending is not permitted. Blend only as specified in the specific AMM maintenance task.

(b)Blend to a sufficient depth to remove all damage that you can see plus 0.002 to 0.003 in. (0.051 to 0.076 mm) of material within the repair limits specified.

(c)Blending must start with the coarser grades of resilient flexible abrasive-impregnated wheels, brushes, or points for the initial removal of damage, but not coarser than is necessary to remove the damage.

(d)Finish blending the part with the finer grades of abrasive until the surface is as smooth as, or smoother than, the adjacent surfaces.

(e)Use grades of abrasives in the order that follows :

1 80 mesh silicon carbide or aluminum oxide grit

2 120 mesh silicon carbide or aluminum oxide grit

3 180 mesh silicon carbide or aluminum oxide grit

4 Optional : Use Polishing Compound (Material No.P05-354) or Polishing Compound (Material No.P05-426) or Polishing Compound (Material No.P05-427) with Cloth Wheel (Non-Coated) (Material No.P05-353) to get a surface finish, if necessary.

R 43.Consumable Materials List

A. List of Materials

WARNING : BEFORE YOU USE ANY OF THE MATERIALS SHOWN IN THIS PUBLICATION, YOU MUST KNOW ALL OF THE PRECAUTIONS RECOMMENDED BY THE MANUFACTURER OR THE SUPPLIER.
THESE PRECAUTIONS TELL YOU HOW TO :
- USE THE MATERIAL SAFELY
- KEEP THE MATERIAL SAFELY
- DISCARD THE MATERIAL SAFELY.
YOU MUST READ THE MATERIAL SAFETY DATA SHEETS (OSHA FORM 20 OR EQUIVALENT) TO LEARN THE RECOMMENDED PRECAUTIONS. THE SAFETY DATA SHEETS ARE SUPPLIED BY THE MANUFACTURER OR THE SUPPLIER OF THE MATERIAL.

(1)Always obey the specific procedures and limits in the AMM maintenance task.

(2)There are two lists which help you manage the consumable materials.

(a)Consumable Materials List

(b) Suppliers List

(3)The Consumable Materials List which follows includes all the consumable materials necessary for the power plant maintenance of all JT9D, PW4000, and PW6000 powered aircraft.

(4)In addition to this list, the Supplier Source Code List is a list of suppliers for procurement of all the consumable materials (Ref. 70-00-00, P. Block 201).

(5)With the use of these two lists, operators of single or multiple aircraft-engine combinations can better manage consumable materials inventory.

TABLE	CATEGORY
01	Fuels
02	Hydraulic Fluids
03	Oils
04	Common Greases
05	Special Materials
06	Lubricants
07	Lacquers
08	Bonding and Adhesive Compounds
09	Sealants
10	Anti-Ice and Deicing Materials
11	Cleaning Agents
12	Strippers
13	Pretreatment for Painting
14	Disinfectants
15	Storage Preservation
16	Structure Paints
17	Microbiological Contamination Protection Materials
18	Primer

(6)Materials index

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
P01- FUELS				
P01-001	Fuel/Engine	PWA 522		S0002
P02- HYDRAULIC FLUIDS				
P02-001	Hydraulic Fluid	Aerospatiale SPEC NSA 307.110	Hyjet IV or IVA	94548
			Skydrol 500/84 Skydrol LD4	76541
P03- OILS				
P03-001	Oil, Lubricating, Turbine Engine	PWA 521, See Service Bulletin 238		S0001
P03-002	Oil, Lubricating	MIL-PRF-6081 Grade 1010 (Latest Revision) (except viscosity at-40°F (-40°C) may be 3300 cs maximum) :		
		PMC 9852	Royco 481	07950

	ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
				Winsor L-110-A	1M647
				Brayco 460	2R128
R R R R R	P03-003	Fluid, (Calibrating for Aircraft Fuel System Components)	MIL-PRF-7024 Type II (Latest Revision) PMC 9041		Local
	P03-004	Oil, Lubricating	MS0240		50907
	P03-005	Oil, Lubricating Molybdenum Disulfide Silicone Base	MIL-L-25681 (Latest Revision)		12474
	P03-006	Oil, Lubricating (Low Temperature)	MIL-PRF-7870 (Latest Revision) PMC 9851	Instrument Oil	1PWD8
	P03-007	Oil, Gage Lubricant and Penetrating Oil	PMC 9534	Marvel Mystery Oil	95015
	P03-012	Compound, Jointing Non-Setting		Mastinox D40	F1419
	P03-014	Oil, Lubricating	MIL-L-89876 (Latest Revision)	Mobil 28	3U728
	P03-015	Fluid, Penetrating (Oil Type)	PMC 9545	318 Versatoil	27732
				LPS LST Penetrant	66724
				Knock'er Loose	023V4
				Metal Guard 500 or Metal	94853

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
			Guard Spray Formula	
P03-016	Fluid, Penetrating (Oil Type)	PMC 9503	Aerokroil	13868
P03-017	Oil, Penetrating	SPMC 188	Solvo-Rust 81252 Super Penetrating Oil	05972
P03-019	Oil, Lubricating and Preservation, Aircraft Instrument and Bearings, Low Volatility	MIL-PRF-6085 PMC 9123		LOCAL
P04- COMMON GREASES				
P04-001	Grease, Aircraft and Instrument, Gear & Actuator Screw	MIL-G-23827 (Latest Revision)		29700
P04-003	Grease		"Aero" Lubriplate, Lubriplate 930AA, or Mo-Lith No. 2	73219
P04-004	Grease		Amber Parmo Grease	29700
P04-005	Grease (Extreme Pressure)	PMC 9630	Lubriplate No. 1200-2	73219
P04-006	Grease	PMC 9631	Plastilube No. 3	1V074
P04-007	Grease	MIL-G-81322 (Latest Revision)	Thrust Reserver System Lubrication	19135
P05- SPECIAL MATERIALS				

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
P05-001	(Deleted)			
P05-002	Tape, Hi Speed		Y9162B or 428B	26066
P05-003	Cloth, Fiberglass	AMS 3824	Style 108, 120, 7781 Volan Finish	4G117
			Style 120, Glass Cloth, F50 Finish Finished for Resin Laminates	2B975 LOCAL
P05-004	Tape, Magic Mending			
P05-005	Cloth, Cotton Lint-Free			LOCAL
P05-006	Compound, Lapping Silicone Carbide (280 Grain Size)	PMC 3011	Clover Silicon Carbide Grease Mix (39401 or 39403)	05972
P05-007	Leak Detector, Liquid-Type	PMC 2277 (-1, -2, -3)	Snoop Liquid Leak Detector	02570
P05-008	(Deleted)			
P05-009	Compound, Corrosion Prevention	MIL-C-11796 Class 3 (Latest Revision) :		
		PMC 9109	Tectyl 437 or Nox-Rust 509	0YMU2
P05-010	(Deleted)			
P05-011	(Deleted)			

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
P05-012	Tape, Adhesive (Double Sided)		Permacel 94, 96, 306, ED8112, ED8117, or ST8117	99742
P05-013	(Deleted)			
P05-014	(Deleted)			
P05-015	Primer, Silicone Rubber (Moved to P18-009)	PWA 556		
P05-016	(Deleted)			
P05-017	Wipers, Cotton (Lint-Free)			LOCAL
P05-018	Pencil, Metal Marking	PMC 4059-2 (Blue)	Stock No. 02443 for Prismacolor Verithin No. 741 -Or- Stock No. 20044 for Col-Erase 1276 -Or- Stock No. 03332 for Prismacolor Thick Lead No. 901	86874
		PMC 4059-3 (Green)	Stock No. 03341 for Prismacolor Thick Lead No. 910 -Or- Stock No. 20046 for Col-Erase	86874

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
			1278	
		PMC 4059-5 (Pink)	Stock No. 03357 for Prismacolor Thick Lead No. 929	86874
		PMC 4059-6 (Red)	Stock No. 00750 for Prismacolor Verithin No. 750 -Or- Stock No. 20045 for Col-Erase 1277 -Or- Stock No. 20066 for Col-Erase 1297 -Or- Stock No. 03351 for Prismacolor Thick Lead No. 922	86874
		PMC 4059-7 (Silver)	Stock No. 02460 for Prismacolor Verithin No. 753 -Or- Stock No. 03375 for Prismacolor Thick Lead No. 949	86874
		PMC 4059-8 (White)	Stock No. 03365 for Prismacolor Thick Lead No. 938 -Or-	86874

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
			Stock No. 02429 for Prismacolor Verithin No. 734 -Or- Stock No. 20055 for Col-Erase 1286	
		PMC 4059-9 (Yellow)	Stock No. 03346 for Prismacolor Thick Lead No. 916 -Or- Stock No. 02431 for Prismacolor Verithin No. 735	86874
		PMC 4059-10 (Red)	Stock No. 00750 for Prismacolor Verithin No. 750	86874
		PMC 4059-11 (Orange)	Stock No. 02435 for Prismacolor Verithin No. 737 -Or- Stock No. 02435 for Prismacolor Verithin No. 737 -Or- Stock No. 03348 for Prismacolor Thick Lead No. 918	86874

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
P05-019	(Deleted)			
P05-020	(Deleted)			
P05-021	(Deleted)			
P05-022	Dye - Layout and Identification	PMC 4062	Miccro Supreme Layout Dye, Purple	59460
P05-023		MISC 41 (Deleted. Use PMC 4058, P05-232)		
P05-024	(Deleted)			
P05-025	Ink, Stamping (For Marking Non-Porous Surfaces with Rubber Stamp)	PMC 4021	1250, Black	4PNW1
P05-026	Ink, Metal Marking	PMC 4057-1	No.9 Black SF	88303
P05-027	(Deleted)			
P05-028	Chromate Conversion Salts, Aluminum	PMC 1794	Alodine #600	71410
P05-029	Chromate Conversion Salts, Aluminum	PMC 1631	Iridite No. 14-2 Compound	76071
P05-030	Wetting Agent	PMC 1632	ARP No. 2	76071
P05-031	(Deleted)			
P05-032	Penetrant, Fluorescent Post-Emulsified	PMC 4353-1 PMC 4353-2 PMC 4353-3 PMC 4353-4	600 ZL27A RC65 P230	S0203 37676 21405 S9502

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
		PMC 4353-5	(Deleted)	
		PMC 4353-6	985-P13	D1940 K6858 02CA7 23373
		PMC 4353-7	FP95A(M)	98733
		PMC 4353-8	F-6A/1P	S0126
P05-033	(Deleted)			
P05-034	(Deleted) (Refer to P05-237)			
P05-035	(Deleted)			
P05-036	(Deleted)			
P05-037	Enamel, Aluminized Epoxy	PWA 569	Enamel Base 529K002, Curing Solution 910K021	23354
P05-038	Cheesecloth - Bleached, New, Woven, Unsized	GA 100-2	100 percent Cotton, 12 x 18 Inches (Minimum) to 20 x 40 Inches (Maximum), 40 x 32 Yarns/Inch	2A851 4N020 80769
P05-039	(Deleted)			
P05-040	Varnish Phenolic Resin, Corrosion-Preventive	AMS 3132	69X0545, Compound	78520
P05-041	(Deleted Refer to P07-001)			
P05-042	(Deleted)			

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
P05-043	(Deleted)			
P05-044	(Deleted)			
P05-045	Pen and Ink, Marking	PMC 4092-1 (Red, Fine Point)	Sharpie 30000 Series - Red (Product Code 30002)	86874
		PMC 4092-2 (Red, Extra Fine Point)	Sharpie 30000 Series - Red (Product Code 35002)	86874
P05-046	(Deleted)			
P05-047	(Deleted)			
P05-048	Stamping Ink, White (Deleted; use P05-049)	PMC 4027		
P05-049	Ink, Metal Marking	PMC 4057-2	White Metal Marking Ink No. 977-9	OER09 LOCAL
P05-050	Abrasive Rod, Rubberized	.3750 OD x 6" (9.525 OD x 152.400 mm)	0066XF	86297
P05-052	Tape, Tying Glass Fiber			00768
P05-053	Coating, Polyurethane	PWA 36013	Laminar X-500 Black Conductive Resin Plus Pigment Component (8-B-6) And Hardener Component (50-C-3)	0KXA5
P05-054	Coating, Polyurethane	PWA 36014	Laminar X-500 White Surfacer Resin Plus Pigment Component (8-W-5)	0KXA5

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
			And Hardener Component (50-C-3)	
P05-055	Emery Paper		#200-325 Grit	LOCAL
P05-056	Emery Paper		#60 Grit	LOCAL
P05-057	Tie Tape		PN 190LOF-21GIG/A	83309
P05-058	Brush, Plater's	GA 55-1	8313	33684
	Tampico		M-904	74291
P05-059	Wax, Paraffin	PMC 9552	Mobilwax 130	57635
	NOTE : P05-396 Paraffin Wax Blend is softer and more reliable than P05-059 Paraffin Wax and can be used as an alternative when P05-059 is specified.			
P05-060	Demineral-ized Water	PMC 1737		LOCAL
P05-061	Crocus Cloth	P-C-458	1.500 inch (38.100 mm) Width	LOCAL
P05-062	Emery Cloth		No. 400	LOCAL
R P05-063	Solvent Reducer	PWA 36050	Thinning Agent	23354
R			020x324	
P05-064	Adhesive Precoat For Greaseless Compound	PMC 3091	Ad-Lea-Sive (ADL-3)	S0226
P05-065	Compound, Polishing, Medium Fine Greaseless	PMC 3048	Grade E	S0226
P05-066	Compound, Polishing	PMC 3061	No. 418	S0226

	ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
		Buffing			
				No. 50	0JYZ0
	P05-067	Brush, Soft Bristle, Nonmetallic			LOCAL
R	P05-068	Nitrogen	PMC 2214		00741
R					0ZDB5
R					07098
R					3GMN8
R	P05-069	Applicator, Wood, Cotton-tip		5-5-405	LOCAL
	P05-074	Tape, Insulating (Glass Cloth, Adhesive)		No. 27	26066
	P05-076	Abrasive Paper, Silicon Carbide Waterproof	P-P-101	No. 400 Grit	LOCAL
	P05-084	Coating, Conversion Aluminum Chromate	SPMC 206	Alodine 1200S	71410
	P05-087	Tape, Pressure Sensitive, Flat Black		No. 250	26066
	P05-089	Staining Color		Prussian Blue	98148
	P05-094	Paper, Aluminum Oxide			LOCAL
	P05-095	Coating, Conversion	MIL-C-5541, Class 1A (Latest Revision)		LOCAL

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
P05-099	Tape, Moisture Resistant, Adhesive (ASTM-D-5486 Type IV), Olive Drab	PMC 4141 -1 thru-5 PMC 4141 -1 trhu-6	AC50 Polyken 231 P-691 tesa 53910	1VJW7 80769 S0202 38XJ0
P05-104	Cloth, Emery		240 Grit	LOCAL
R P05-110 R R	Safety Wire (Lockwire)	MS9226-03	0.025 in. (0.635 mm) Diameter	LOCAL
P05-111	Tape, Fiberglass Insulating		Scotch 69	04963
P05-113	Release Agent, Fluoro-carbon			18598
P05-124	Twist Ties			LOCAL
P05-125	Tape, Teflon		6 Mil	71643
P05-126	Brush, Short Bristle Nylon			LOCAL
P05-127	Alodine, Brush		No. 1200 (Touch-up)	84063
P05-131	Non-Metallic Grit Cloth		No. 90 Grit	LOCAL
P05-132	Abrasive Paper	Light Grade 0		LOCAL
P05-133	Mold Release	PWA 36007 (Aerosol)	MS-122AD or MS-122XD Solvent-Based	18598
P05-134	Cloth,	AMS 3902	Style 285	4G117

R NOTE : P05-288 is a preferred alternative to P05-110.

NOTE : Refer to P05-355 for a water based alternative.

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
	Organic Fiber			
			Style 243	4L264
			HK 285	S0175
P05-135	Tape, Heat Reflective (Aluminum Foil Backed, Glass Cloth Laminated	PMC 4235	(-1 Thru -12 :)	
		36 Yards Rolls	No. 363	52152
		Width As Follows :	No. 407	60890
		(-5, -10) : 1/4 Inch	No. P-100	99742
		(-1, -6) : 1/2 Inch	No. 390	1A319
		(-2, -7) : 1 Inch	No. 2925-7	07512
		(-3, -8) : 2 Inches	(-6 Thru -11 :)	
		(-4, -9) : 4 Inches	No. C642	07512
		(-11) : 1/8 Inches		
		(-12) : 3 Inches		
P05-136	Tape, High Tempereature Glass Cloth	PMC 4273	All Dash Numbers Except -7 :	
		Length = 36 Or	No. 361 Glass Cloth Tape	52152
		60 Yards Width As Follows :	D/W 469	60890
		-1 = 1/4 Inch	497	3TYN6
		-2 = 1/2 Inch	2915-7	07512
		-3 = 1.0 Inch		
		-4 = 2.0 Inches		
		-5 = 4.0 Inches		
		-6 = 6.0 Inches		
		-7 = 4.0	All Dash	

	ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
			Inches -8 = 3.0 Inches	Numbers : Permacel No. 212	99742
	P05-137	Bonding Prevent-active, Teflon S	PWA 36038	No. 954-101	23037(D)
	P05-139	Cloth, Emery		No. 100 - 200	LOCAL
	P05-142	Tape, Silicone Glass Cloth		Scotch No. 361	26066
	P05-143	Clay, Molding, Gray		Clayola, 1 1b. (0.45 kg) Package 700619 Plasteline, 1 1b. (0.45 kg) Package	85419 86293
R	P05-145	Tape, Masking, Polyester Film (Mylar)	PMC 4188	Scotch No. 8402 Or 8403 CT-931 Temp-R-Tape M50 No. 594 Blue Poly Flexible Tape 24-06BL115	52152 9X057 07512 3FJ16
	P05-146	Abrasive Paper, Silicon Carbide		120 Grit	39428
	P05-147	Milled Glass		Owens-Corning	45255
	P05-152	Wetting Agent	PMC 1610	Alconox	17534
	P05-153	Abrasive Paper, Silicon		240 Grit	LOCAL 03251 39428

	ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
		Carbide			
					03251 39428
	P05-154	Coating, Polyurethane, Erosion Resistant	PWA 36510	Chemglaze M331 and Chemglaze M201	30676
	P05-155	Paper, Kraft Medium Duty	PMC 4128		80861
R R R R	P05-165	Wire, Welding Titanium Alloy	AMS 4954	6AI-4V	2R602 3G172 58401 1GD26
	P05-169	Foil, Aluminum			LOCAL
	P05-182	Cloth, Wire	PWA 1170-3		05160 S0118 S0119
	P05-185	Paper, Test, pH		No. 345, Short Range 6.0 - 8.0	93255
	P05-191	Tape, Electrical Insulating, Self-Adhering, High Temperature		RL-6000 SA Series	LOCAL
	P05-198	Gloves, Plastic Polyethylene	GA 660-4	Edmont and Wilson No. 35-152	44926
	P05-203	Paper, Kraft Light Duty	PMC 4127	Kraft Paper	80861
	P05-214	Cloth, Abrasive Impregnated Nylon, Fine Silicon Carbide	GA 814-3	Type S Fine Scotch - Brite Cleaning and Finishing Sheets	76381

	ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
	P05-221	Filler, Aerodynamic Dent		800000-328	73168
R R R	P05-231	Tape, Adhesive Transfer	PWA 36745	Densil 4078K Transfer Tape	62369
	P05-232	Crayon, Metal Marking (Soft)	PMC 4058-1 (Black)	02089	86874
			PMC 4058-6 (Red)	02059	86874
			PMC 4058-8 (White)	02412 or 02060	86874
				Phano #92	70362
			PMC 4058-10 (Orange)	02094	86874
			PMC 4058-11 (Yellow)	#73	70362
	P05-233	Brush, Tube Nylon Bristle		1/2 Inch OD and 18 Inch Long Minimum	LOCAL
	P05-234	Penetrant, Fluorescent, Post-Emulsified, Normal Sensitivity (Level 2)	PMC 4352-1	555	S0203
			PMC 4352-2	ZL2C	37676
			PMC 4352-3	RC50	21405
			PMC 4352-4	P220	S9502
			PMC 4352-5	(Deleted)	
			PMC 4352-6	985-P12	D1940 K6858 02CA7 23373
			PMC 4352-7	FP93A(M)	98733
			PMC 4352-8	F-5-SP/1P	S0126
	P05-235	Penetrant, Fluorescent, Post-Emulsified, Ultra High Sensitivity (Level 4)	PMC 4354-1	668	S0203
			PMC 4354-2	ZL37	37676
			PMC 4354-3	RC77	21405
			PMC 4354-4	P240	S9502
			PMC 4354-5	(Deleted)	
			PMC 4354-6	985P14	D1940 K6858 02CA7 23373
			PMC 4354-7	FP97A(M)	98733

	ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
			PMC 4354-8	F-6A-SP/1P	S0126
	P05-236	Penetrant,	PMC 4360-1	446	S0203
		Fluorescent	PMC 4360-2	ZL67	37676
		Water	PMC 4360-3	HM604	21405
		Washable,	PMC 4360-4	P130	S9502
		High	PMC 4360-5	(Deleted)	
		Sensitivity	PMC 4360-6	970-P25E	D1940
		(Level 3)			K6858
					02CA7
					23373
			PMC 4360-7	FP-923	98733
			PMC 4360-8	F-4A-C/1P	S0126
R	P05-237	Developer-	PMC 4357	Chemetall	D1940
R		Fluorescent		Oakite	K6858
R		Penetrant,		9D1B	02CA7
R		Non-aqueous			23373
R					
R				Eishin	S0126
R				Kagaku	
R				F-4S(NT)1	
R					
R				Ely LD3	K2063
R	NOTE : Ely LD3 has been discontinued. It is acceptable to use existing stock on hand.				
R					
R				Magnaflux	37676
R				ZP9F	
R					
R				Marktec D701	S9502
R					
R				Met-L-Chek	98733
R				D70	
R					
R				Sherwin	21405
R				D100	
	P05-238	(Deleted)			
	P05-240	Not available-Use P05-459			
	P05-243	Paper, Emery		No. 320 Grit	LOCAL
	P05-245	Tape, Lacing		BMS13-54	82110

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
			Grade D, Type 3 or Gudebrod 718Z	
P05-246	Tape, Electrical		Scotch 62	04963
P05-247	Tape, Electrical		Scotch 92	04963
P05-248	Tape, Rubber		Moxness 620-1 (Red or Black)	07099
P05-249	Coating, Urethane	MIL-C-83286, Type I, No. 26306 (Latest Revision)		97460
P05-250	Coating, Urethane	MIL-C-83286, Type II, No. 26251 (Latest Revision)		97460
P05-252	Pad, Scotch Brite			04963
P05-253	Paper, Abrasive		Silicon Carbide, 180 Grit	LOCAL
P05-254	Knife, Acrylic			LOCAL
P05-255	Tape, Masking		Scotch 8402 or 8403	52152
P05-256	Brush, Acid		No. 225	20696
P05-258	Coating, Silicone Insulation		MI-15 Type II Parts A, B and C	53100
P05-259	Topcoat, Silicone		MI-15 Parts A and B,	53100

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
	Insulation		Thinner	
P05-260	Spatula, Acrylic or Fiber			LOCAL
P05-262	Lockwire	MS20995C32		LOCAL
R NOTE : P05-288 is a preferred alternative to P05-262.				
P05-264	Film, Bagging (VAC-PAC)		2 MIL Nylon	66442
P05-268	Film, Release	PMC 9977	A4000P	53912
P05-272	Tape, Sealing		Scotch 425 or Scotch Y427	52152
P05-273	Syringe, Plastic Nozzle			LOCAL
P05-274	Paper, Abrasive		Silicon Carbide 80 Grit	LOCAL
P05-277	Sheet, Rubber, Silicone		0.125 Inch (3.175 mm) Thick	LOCAL
P05-278	Tape, Protective Polyurethane		3M Part No. 8672	52152
P05-279	Coating, Clear Polyurethane		683-2	98502
P05-285	Fabric Fiberglass Epoxy		Type I HMF 2398D/76 Type II HMF 2367D/76	07314
P05-287	Safety Wire (Lockwire)	MS20995C20	0.020 Inch (0.508 mm) Diameter	LOCAL

	ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
R	NOTE : P05-288 is a preferred alternative to P05-287.				
	P05-288	Safety Wire (Lockwire) - Steel, Corrosion Resistant	AS3214-01 (AMS 5689, AISI 321)	0.020 Inch (0.508 mm) Diameter	LOCAL 1A053 94129
R	NOTE : P05-288 is a preferred alternative to P05-110, P05-262, and P05-287.				
	P05-289	Safety Wire (Lockwire) - Steel, Corrosion Resistant	AS3214-02 (AMS 5689, AISI 321)	0.032 Inch (0.813 mm) Diameter	LOCAL 1A053 94129
	NOTE : P05-332 is an approved alternative to P05-289.				
	P05-290	Chafe Guard, Fluorocarbon Film	ASTM D3368		09421
	P05-291	Cable, Safety		C30B AS3510-0212C AS3510-0218C AS3510-0221C AS3510-0224C 0.032 Inch (0.813 mm) Diameter	70958
	P05-292	Ferrule, Safety Cable		F30B50 AS3510-02F 0.032 Inch (0.813 mm) Diameter	70958
R	P05-303	Sponge, Silicone Rubber, 0.040 In. Thick		AMS 3195	50744
R	P05-304	Sponge, Silicone Rubber, 0.080 In. Thick		AMS 3195	50744

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
P05-305	Wrap, Tube Spiral	MIL-T-4787A Type 1, Size 1/8 (Latest Revision)		92194
P05-306	Wrap, Tube Spiral	MIL-T-4787A Type 1, Size 1/4 (Latest Revision)		92194
P05-307	Tape, High Temperature Flash		TM6044-02	0VB34
P05-316	Netting, Bondline		BSK1177	07542
P05-317	Adhesion Promoter, Polyurethane Protective Tape		Adhesion Promoter 86A	52152
P05-326	Spare Patch, Firecoat		71M060S001 12.0 Inch X 12.0 Inch X 0.135 Inch (304.800 mm X 304.800 mm X 3.429 mm)	38597
P05-327	Spare Patch, Firecoat		71M060S002 12.0 Inch X 12.0 Inch X 0.215 Inch (304.800 mm X 304.800 mm X 5.461 mm)	38597
P05-328	Spare Patch, Firecoat		71M060S003 12.0 Inch X 12.0 Inch X 0.080 Inch (304.800 mm X 304.800 mm X 2.032 mm)	38597

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
P05-329	Spare Patch, Firecoat		71M060S004 24.0 Inch X 24.0 Inch X 0.195 Inch (609.600 mm X 609.600 mm X 4.953 mm)	38597
P05-330	Spare Patch, Firecoat		71M060S005 24.0 Inch X 24.0 Inch X 0.215 Inch (609.600 mm X 609.600 mm X 5.461 mm)	38597
P05-332	Safety Wire (Lockwire)	MS9226-04	0.032 Inch (0.813 mm) Diameter	LOCAL
NOTE : P05-289 is an approved alternative to P05-332.				
P05-334	Brush, Bristle (1.0 Inch (25.400 mm) Wide)		08705100	45773
P05-339	Thinner		TL-49	98502
P05-340	Catalyst		Catalyst X-310A	98502
P05-342	Activator		BSB Durofix	F6662
P05-343	(Deleted)			
P05-350	Wheel, Grinding, Rubber Bonded "Radiac"		C100-102CHSC	54916 S0055
P05-351	Wheel, Grinding, Rubber Bonded "Rex Cut"		C180-KRC1	75554 S0055
P05-353	Wheel, Cloth			LOCAL

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
P05-354	Compound, Aluminum Oxide Polishing and Buffing	PMC 3017	Moco 1062	S0055
P05-355	Agent, Mold Release (For Composite Parts Water Base)	PMC 1108	Water-Shield	047D8
P05-360	Applicator, Manual (LP-50 Cartridge)		9MGUN509X	30676
P05-361	Nozzle, Mixing		9742	30676
P05-366	Dye, Layout and Identifi-cation	PMC 4039-1: Purple	LM-170 Layout Dye	S0144
		PMC 4039-2: Blue	Dykem Spray Steel Blue Part #80000	98148
P05-370	Coating, Fluoroelastomer Protective	PWA 36515-1	PLV 2000 (Black) Accelerator #4	24802
P05-371	Coating, Fluoroelastomer Protective	PWA 36515-2	PLV 2100 (Black) Accelerator #4	24802
P05-372	Coating, Fluoroelastomer Protective	PWA 36516-4	PELSEAL 2112 (Black) Accelerator #4	24802
P05-376	Tape, Masking (Crepe Paper Backing) Length: 60 Yards;	PMC 4000-1 Thru -8 and -10	tesa 53120	S0099
			PG-4	12861
			Permacel No. 791 Tape	99742
	Width/Suffix: 1/8 Inch:		#2505	76381

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
	(-1, -11, -21) 1/4 Inch: (-2, -12, -22) 3/8 Inch: (-3, -13, -23) 1/2 Inch: (-4, -14, -24) 3/4 Inch: (-5, -15, -25) 7/8 Inch: (-6, -16, -26) 1 Inch: (-7, -17, -27) 2 Inch: (-8, -18, -28) 4 Inch: (-9, -19, -29) 1/2 Inch: (-10, -20, -30)		Utility Paper Tape or Tartan Brand No. 200 Paper Tape	
			PG-500	6Y517
			Clipper Tape 7100	0A9Y2
		PMC 4000-1 Thru -8 and -10 Thru -20	PG-21 or PG-24	6Y517
		PMC 4000-9	PG-500	6Y517
		PMC 4000-21 Thru -30	Scotch No. 234	04963
P05-384	Compound, Silicon Carbide Deburring (150 Grit and Finer)	PMC 3088	Compound No. 7280	S0055
P05-395	Beeswax (Was: P06-015)	PMC 9463	White Beeswax S.P. 422	0A341
			Yellow Beeswax S.P.6	0A341
			Beeswax (Yellow - Natural)	33629
			Yellow Beeswax S.P.	0A341

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
			6	

NOTE : The alternative to P05-395 Beeswax is P05-396 Paraffin Wax Blend, which is softer and more pliable.

R	P05-396	Paraffin Wax Blend	PMC 9462	CW-5	24269

NOTE : P05-396 Paraffin Wax Blend is softer and more pliable than P05-395 Beeswax or P05-059 Paraffin Wax and can be used as an alternative to these materials.

P05-400	Sheet, Silicone Rubber		ZZ-R-765, Class 3B, Grade 50 0.0625 Inch (1.587 mm) or 0.0937 Inch (2.381 mm) Thickness	19955
P05-408	Marker, Felt Tip, White	SPMC 198-1	High Purity Action Marker #44729 - 4.5 x 25.4 mm Tip #33729 - 2.0 x 14.5 mm Tip	98148
P05-409	Marker, Metal Tip, Black	SPMC 198-2	High Purity Texpen #17470 - Fine Tip #17473 - Medium Tip #17474 - Broad Tip	98148
P05-410	Marker, Felt Tip	SPMC 198-3	Sharpie Fine Point Marker "Yellow"	86874
P05-411	Ink, Stamping (For Marking on Non-Porous Surfaces with	PMC 4021	Permanent Stamp Pad Ink No. 58757	86874

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
	a Rubber Stamp			
P05-412	Ink, White, Stamping (Deleted ; use P05-049)	PMC 4027 (Deleted ; use PMC 4057-2)		
P05-413	Ink, Temporary Marking	PMC 4500	16-2000 VideoJet Ink, (Black)	0V0Z6
P05-414	Marker, Extra Fine Point (Black)	PMC 4557	Pilot SCA-UF	58595
P05-415	Marking Pen - Permanent, Trace Element Certified (TEC)	PMC 4556	#13401 Black, Fine Tip or #13501 Black, Broad Tip	86874
P05-416	Chalk, White	PMC 4552	No. 1400 Crayola An-Du-Septic White Chalk	85419
R P05-417 R R	Marking Pen (Paint)	PMC 4554	Uni-Paint Marker PX-20, 63613 (White) and 63605 (Yellow)	86874
P05-418	Dye, Layout and Identification (Blue)	PMC 4504	Dykem Steel Blue Part No. 80600 (930 Ml) or Part No. 80400 (8 oz.)	98148
P05-419	Dye, Layout and Identification (Red)	PMC 4503	Dykem Steel Red Layout Fluid	98148

	ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
				(80496)	
	P05-420	Marking Pencil (Hard)	PMC 4094	02460 or 21628	86874
R	P05-421	Pad, Scrub	PMC 4095	Scotch Brite #7447 General Purpose Pads	28124
R				747 Non-Woven Pad	1E1X8
R				54902	17699
R	P05-422	Pad, Scrub	PMC 4435	Scotch Brite Ultra Fine Pads #7448	28124
	P05-423	Marker, Felt Tip, Rapid Drying	PMC 4050, -1 (Black, Chisel Point)	Marks-A-Lot	16956
			(Black, Chisel Point, (38264)	Sharpie King Size Marker, and Magnum Marker	86874
			PMC 4050-2 (Blue, Chisel Point)	Marks-A-Lot	16956
			PMC 4050-3 (Red, Chisel Point)	Marks-A-Lot	16956
			PMC 4050-4 (Black, Fine Point)	Marks-A-Lot	16956
				Dixon Redi-Sharp	70362
				Sharpie 30000 Series - Black (Product Code #30001)	86874

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
		PMC 4050-5 (Green, Chisel Point)	Marks-A-Lot	16956
		PMC 4050-6 (Blue, Fine Point)	Sharpie 30000 Series - Blue (Product Code #30003)	86874
		PMC 4050-7 (Red, Fine Point)	Sharpie 30000 Series - Red (Product Code #30002)	86874
		PMC 4050-9 (Red, chisel Point)	Marks-A-Lot	16956
		PMC 4050-10 (Yellow, Fine Point)	Sharpie 30000 Series (Product Code 30005)	86874
		PMC 4050-11 (Black, Extra fine)	Sharpie 35000 Series (Product Code 35001)	86874
		PMC 4050-12 (Red, Extra Fine)	Sharpie 35000 Series (Product Code 35002)	86874
		PMC 4050-13 (Blue, Extra Fine)	Sharpie 35000 Series (Product Code 35003)	86874
		PMC 4050-14 (Black, Utra Fine)	Sharpie 37000 Series (Product Code 37001)	86874
		PMC 4050-15	Sharpie	86874

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
		(Red, Utra, Fine)	37000 Series (Product Code 37002)	
		PMC 4050-16 (Blue, Utra Fine)	Sharpie 37000 Series (Product Code 37003)	86874
		PMC 4050-17 (Black, Bold/Fine)	Sharpie 33000 Series (Product Code 33001)	86874
		PMC 4050-18 (Red, Bold/Fine)	Sharpie 33000 Series (Product Code 33002)	86874
		PMC 4050-19 (Blue, Bold/Fine)	Sharpie 33000 Series (Product Code 33003)	86874
		PMC 4050-20 (Black, Fine Tip)	TEC #13401	86874
		PMC 4050-22 (Metallic Silver, Fine Tip)	Sharpie (Product Code 39100)	86874

R NOTE : (1) Approved for use on nickel superalloys and ceramic, aluminide,
R and overlay coatings. PMC 4050-1, -4, and -17.
R (2) Approved for use on nickel superalloys and aluminide, and overlay
R coatings. PMC 4050-6, -13, -16, and -19.
R (3) Approved for use on ceramic, overlay, and aluminide coatings.
R PMC 40450-7, -12, -15, and -18.

P05-424	Penetrant, Fluorescent, Water Washable, Normal Sensitivity (Level 2)	PMC 4351-1	Ely Chemical 4455	S0203
		PMC 4351-2	Magnaflux ZL60D	37676
		PMC 4351-3	Sherwin HM406	21405
		PMC 4351-4	Marktec P121	S9502
		PMC 4351-5	(Deleted)	

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
		PMC 4351-6	Chemetall 970-P24	D1940 S0178 02CA7 23373
		PMC 4351-7	Met-L-Chek FP922	98733
P05-425	Pen, Water Resistant, Instant Drying	PMC 4421	Sharpie Marker and Super Sharpie Marker :	86874
		-1 : Fine Point	#30001 - Black (1 mm line width)	
		-2 : Fine Point	#30002 - Red (1 mm line width)	
		-3 : Fine Point	#30003 - Blue (1 mm line width)	
		-4 : Fine Point	#30005 - Yellow (1 mm line width)	
		-10 : Extra Fine Point	#35001 - Black (.4 mm line width)	
		-11 : Extra Fine Point	#35002 - Red (.4 mm line width)	
		-12 : Extra Fine Point	#35003 - Blue (.4 mm line width)	
		-20 : Ultra Fine Point	#37000 - Black (.3 mm line width)	
		-21 : Ultra Fine Point	#37002 - Red (.3 mm line width)	

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
		-22 : Ultra Fine Point	#37003 - Blue (.3 mm line width)	
		-31 : Bold Fine Point	#33001 - Black (4 mm line width)	
		-32 : Bold Fine Point	#33002 - Red (4 mm line width)	
		-33 : Bold Fine Point	#33003 - Blue (4 mm line width)	
P05-426	Compound, Polishing, Greaseless, Coarse	PMC 3022	Greaseless Compound Grade 3022-1	S0226
P05-427	Compound, Polishing, Greaseless, Fine	PMC 3023	Greaseless Compound Grade A	75554
P05-437	Tape, Pressure Sensitive Polyester	PMC 4096	Flashbreaker 1 (0.002 In. thick) and	53912
			Flashbreaker 2 (0.003 In. thick)	53912
			Flashtape 1 (0.002 In. thick)	3BEV4
P05-441	Ink, Metal Marking	PMC 4057-10	Koh-I-Noor White Drawing Ink #9065-D	2J209
P05-442	Wheel, Abrasive Impregnated Nylon (80 Grit)		2 X 1/2 Inch Bear-Tex	06565

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
P05-443	Wheel, Abrasive Impregnated Nylon (120 Grit)		2 X 1/2 Inch Bear-Tex	06565
P05-444	Wheel, Abrasive Impregnated Nylon (180 Grit)		2 X 1/2 Inch Bear-Tex	06565
P05-459	Blue Dye	PMC 4513	Oil Blue B Liquid Dye	1ML15
P05-465	Ink, Metal Marking	PMC 4057-5	No.9 Green SF	88303
P05-466	Ink, Metal Marking (Deleted Refer to P05-049)	PMC 4057-11 (Refer to PMC 4057-2)	White Metal Marking Ink #977-9	
P05-469	Developing Powder Fluorescent Penetrant	PMC 4356	Chemetall Oakite 9D4A	D1940 K6858 02CA7 23373
			Ely Chemical PD3	K2063
			Magnaflux ZP4B	37676
			Marktec D700	S9502
			Met-L-Chek D72A	98733
			Sherwin D90G	21405
			Eishin Kagaku F-5D/1	S0126
P05-470	Marker, High Purity (Blue)	PMC 4563-1	High Purity Action	98148

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
			Marker 44 (44534)- Medium Tip	
P05-471	Marker, High Purity/High Temperature (Blue)	PMC 4563-2	High Temperature Action Marker 44 (44094) - Medium Tip	98148
P05-472	Marker- High Purity, Black, Trace Element Certified	PMC 4564	High Purity Fine Line 33 (33404)	98148
			High Purity Medium Line 44 (44404)	
P05-473	Tape, Polyurethane	PMC 4121-8	Scotch 8663 (Black)	52152
P05-474	Film, Polyimide	PWA 36071-2	Kapton 200-HN) (0.002 in. thick)	9A090
P05-475	Wire, welding Titanium	PWA 1281	Titanium	2R602
P05-476	Compound, Coating	PWA 36595	Aluminum, Inorganic Binder	53012
P05-477	Marker, High Temperature (Blue)	PMC 4563-3	High Temperature Action Marker 33 - Fine Tip (Special Order)	98148
P05-478	Wire, Nickel-Chromium/ Aluminum	PWA 36947	Type : 73MXC Type : PoMet 886	26057 55596

	ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
		Alloy			
R	P05-482	Solvent Reducer	PWA 36106	IP-715 Solvent Reducer	00BB6
R	P05-483	Enamel - Aluminized Epoxy, Room Temperature Curing, Chromate-Free, Low Volatile Organic Compound Content	PWA 36569	Enamel Base (IP-715A)	00BB6
				Curing Solution (IP-715B Catalyst)	00BB6
R	P05-486	Safety Wire (Lockwire)	MS20995N32	Inconel 0.032 Inch (0.813 mm) Diameter	LOCAL
R	NOTE : P05-289 is an preferred alternative to P05-486.				
	P06- LUBRICANTS				
	P06-001	Lubricant, Dry Film	PMC 9934-1	dgf-123 (CFC-free) Stock No. K5200	16837
	P06-002	Petrolatum, White	PMC 9609	White Phonoline	S0212
				or White Protopet 1S	S0212
R				Vaseline	S0233
				Penreco Regent or Penreco Snow	00BA9
	P06-003	Compound, Antigalling	PWA 586 (Replaces PWA 586-3)	Loctite C-200	05972
				Kaylube No. 3 (for fasteners	15653

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
			only)	
P06-004	Lubricant, Spray-Type Low Temperature	MIL-L-8937 (Latest Revision) : PMC 1714	Everlube 620C	8F024
P06-005	Compound, Antigallant Metal Assembly Paste	PWA 587	G-N Metal Assembly Paste	71984
P06-006	Lubricant (Deleted)	PMC 9125	Rust Pel 1000 (No longer available; use remaining supply)	
P06-007	Petroleum Jelly (Deleted; use P06-002)		Vaseline	
P06-008	Compound, Parting		Vydax AR	18873
P06-009	Lubricant, Molybdenum Disulfide Powder	PMC 9523	Molykote Powder	71984
P06-010	Compound, Antiseize		BG Mica-Tube A719 or A768	05045
P06-011	(Deleted)			
P06-012	Lubricant, Solid Film (Air Cure)		Lubribond A	85932
P06-013	Lubricant, Solid Film (Air Cure)	MIL-L-23398, (Latest Revision)	3402C Bonded Lube	71984
R P06-014	Lubricant, Gasket	PMC 9652	Gredag R-3	04347

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
P06-015	Beeswax	(Deleted, Use P05-395)		
P06-016	Cancelled. No longer Manufactured. For Replacement, Refer to SPM PN 585005, 70-00-00 Assembly-01 (Task 70-00-00-400 -101).			
P06-017	Lubricant, Antiseize	PWA 541	Molybdenum Disulfide Powder :	
			Z Moly Powder -PLUS- Grade 1010	71984
			Oil :	
			Brayco 460 or	2R128
			Royco 481 or Winsor L110-A	07950 1M647
P06-019	Lubricant, Bolt	PMC 9866 (Not available; use P03-001)	All-Oil Gear Lube SAE 250 (No longer available; use any remaining supply)	
P06-020	Lubricant Molybdenum Disulfide, Silicone	DOS-L-25681 (Superseding MIL-L-25681)	Chemsol	012L8 00BB6
			Royco 81MS	07950
			Stock # 9150005437220	0PGK2
			Braycote 868	1UGB2

	ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
	P06-021	Compound, Antigalling	PWA 550-3	Hi-T 650	34227
			Lubri-Bond HT		8F024
	P06-022	Compound, Antigalling and Treatment	PWA 474	Ecoalube 642	8F024
	P06-023	Lubricant, Thread	PWA 36001 PMC 9940	Silver Goop	02570
R R	P06-027	Lubricant		Aerolubri-plate	73219
	P06-034	Silicon Spray, Extreme Duty	PMC4721	03030	023V4
	P06-035	(Deleted) Use P06-053, Sealing Ring Lubricant or P03-001, Engine Oil	PWA 36511		
	P06-036	Compound, Antigallant	PWA 36035	Loctite Moly Dry Film	05972
	P06-037	Compound, Anti-Seize	PWA 36053-4	JET-LUBE	
				NIKAL	0A307
	P06-038	Compound, Antigallant	PWA 36545-3	Everlube Esnalube 382	8F024
	P06-039	Lubricant, Anti-Seize (Deleted; use P06-055)			
	P06-040	Lubricant		MSC-3528	76541
	P06-042	Lubricant, Hydraulic Assembly		MC5.4	

	ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
	P06-043	Compound, Anti-Seize	PWA 36053-1	Never-seez Pure Nickel Special	5W425 75437
	P06-044	Compound, Antigalling	PWA 36240	Dow Corning 321 Dry Film Lubricant Sray	71984 77445
	P06-053	Lubricant, Sealing Ring	PWA 36500	Ultrachem Assembly Fluid #1	56385
				ROYCO HF825	07950
R R R	P06-054	Compound, Paste, Anti-Seize	PWA 36246-1	Tiodize T8E	34568
R R R		Compound, Paste, Anti-Seize	PWA 36246-2	Molykote P-37	71984
	P06-055	Compound, Anti-Seize	PMC 9566 (-1, -2, -3)	C5-A Copper Based Anti-Seize	05972
	P06-059	Lubricant, Fluorinated Grease	PWA 36230	Krytox 283 AD High Temperature Anti-Corrosion Grease	23037(A)
	P07- LACQUERS				
	P07-001	Lacquer	PMC 1641	Crystal Clear Acrylic Spray (No. 1303)	54636
	P08- BONDING AND ADHESIVE COMPOUNDS				
	P08-001	Epoxy, Multi-Component Type	PWA 604-1	Resin Base, Eccobond 45 Hardener	04552

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
			Eccoband 15	
P08-002	Liquid Epoxy Resin	PWA 421-2	Epon No. 828 (medium viscosity)	18598 54527 74230
				54527 74230
P08-003	Phonolic Micro-balloons	PWA 420	UCC BJO-0930	61637
P08-004	Glass Microballoons	PWA 450-1	Type FTD-202 Eccospheres	04552
P08-005	Adhesive	PWA 36027	Scotch Grip Rubber Adhesive No. 1300	76381
P08-006	Adhesive Acryloid		HF-819	77902
P08-010	Adhesive		EC-1300	04963
P08-011	Thickening Agent	PWA 424-2	CAB-O-SIL-MS	3F733
P08-012	Epoxy Resin Curing Agent (Amine Type)	PWA 422-1	Epon Curing Agent "U" or Epicure 3282	18598 54527 74230
P08-016	Adhesive Paste, Epoxy, Non-Thixo-tropic, Aluminum-Filled	PWA 457-1	EA 934 NA	33564
P08-020	Thickening Agent	PWA 424-1	Cab-O-Sil HS-5	3F733 65483
P08-021	Compound, Potting	PWA 603	Eccobond SF-40	04552

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
P08-024	Compound, Retaining	MIL-S-46163 (Latest revision)		05972
P08-025	Adhesive Paste, Epoxy, Thixotropic, Aluminum-Filled	PWA 457-2	EA 9394	33564
P08-026	Adhesive, Epoxy Film		FM-300 Supported	07542
P08-030	Filler, Epoxy	PWA 36756	EC3524 B/A	6A670
P08-032	Adhesive Resin, High Temperature Epoxy		EA9394 Type II	33564
P08-033	Compound, Fairing		EA960F	33564
P08-036	Resin and Curing Agent, Liquid Epoxy	PWA 466	EPON 828/ Curing Agent U Sempak or	23354
R			Epi-cure 3283	74230
P08-038	Adhesive, Urethane		7520A/B, LP-50 Cartridge	30676
P08-044	Adhesive Paste, Epoxy (Toughened), Thixotropic, Aluminum-Filled	PWA 457-5	EA 9392	33564
P08-047	Fabric, Fiberglass, Epoxy Resin Impregnated	PWA 36437	Cycom306/7781	04622
P08-048	Curing Agent, Epoxy	PWA 36436	Epi-Cure W Curing Agent	18598 3FBZ6

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
	(Aromatic Amine Type		(AMS 2825)	74230
P08-049	Adhesive Film, Epoxy Scrim Supported	PWA 477	Hysol EA9628 Supported	33564
P08-050	Adhesive/ Sealant Flame Resistant	PWA 36751-1 Liquid Adhesive and Liquid Curing Agent	DAPCO 18-4F	0JWE8 1XNT8 74230
		PWA 36751-2 Liquid Sealant and Liquid Curing Agent	DAPCO #2030	1XNT8

NOTE : When PWA 36751 is specified, PWA 36751-1 must apply. PWA 36751-1 is used as a filler material for sealing gaps in firewall structures. Compound is applied over a primer. PWA 36751-2 is used as a flame rotardant coating and a cryogenic sealant.

P08-053	Epoxy Paste Adhesive		Hysol EA 956	33564
P08-054	Epoxy Paste Adhesive		Hysol EA 9390	33564
P08-055	Adhesive/ Promoter - Air Drying, Water based (Used with P08-046 for bonding to metal surfaces)		PR 182 Pink	23354 92108
P08-056	Compound, Sealing, Polysulfide (T) Rubber. Alternate to	AMS 3265		23354

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
	P08-046)			
P09- SEALANTS				
P09-001	Sealant, Silicone With Catalyst		DC-90-006	71984
			DC-90-006-2	
P09-002	Compound, Thread Locking and Retaining*	PWA 549-1	Loctite Grade 609 Green - Retaining	05972
	*Specify Grade	PWA 549-2	Loctite Grade 640 Green - Retaining	
		PWA 549-3	Loctite Grade 635 Green - Retaining	
		PWA 549-4	Loctite Grade 222 Purple - Thread Lock	
		PWA 549-5	Loctite Grade 242 Blue - Thread Lock	
		PWA 549-6	Loctite Grade 271 Red - Thread Lock	
		PWA 549-7	Loctite Grade 290 Green - Thread Lock	
		PWA 549-8	Loctite Grade 567 Off-white - Thread Lock	

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
		PWA 549-9	Loctite Grade 272 Red - Thread Lock	
		PWA 549-10 (can be a substitute for PWA 549-2)	Loctite Grade 620 Green - Retaining	
P09-003	Sealant, Silicone Rubber	PMC 9926	DC-4	71984
P09-004	Sealant, Rubber		DC-732	71984
P09-005	Compound, Jointing	PWA 36000 (PWA 36000-3 discontinued)	Hylomar Advanced Formulation methylene chloride free	1ZC62 B1050 S0101 22819

NOTE : When PWA 36000 is specified with or without a suffix, use the product above. The suffixes that indicated viscosity have been discontinued.

P09-006	Sealing Compound	PWA 36000-4 (Superseded by PWA 36000 ; see P09-005)		
P09-007	Sealing Compound	PMC 9925 (Superseded by PWA 36002 ; see P09-008)		
P09-008	Sealing Compound	PMC 9931 (Cancelled)		
		PWA 36002 (Supersedes PMC 9931 and PMC 9925)	Gasket Sealant No. 2	05972

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
			Sealant No. 2	
P09-009	Sealing Compound	PMC 9929	Parker O-Lube	02697
P09-011	Compound, Silicone Rubber, High Temperature Resistant	PWA 404-1	Silastic J (Use PWA 556 Primer ; see P18-009)	0JWE8 71984 74230 98500
			RTV 630/RTV 668 (Use PWA 36086-1 Primer for both ; see P18-007. Use PWA 556 Primer for RTV 668 ; see P18-009)	0JWE8 01139(A) 74230 98500
			Dapcocast 37 (Use PWA 36086-2 Primer ; see P18-007)	0JWE8 1XNT8
		PWA 404-2	V-612 A/B (Use PWA 556 Primer ; see P18-009)	0JWE8 S0183 74230
			Thermosil 4000 (Use PWA 556 Primer ; see P18-009)	74230
P09-012	Sealing Compound		DC Type 3116	71984
P09-013	Sealing Coating Compound, Corrosion Inhibitive	MIL-S-81733 (Latest Revision)	AC-665 B-2	1DWR5

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
P09-014	Sealant, Silicone Rubber	PWA 36003-1 (Use when PWA 36003 is specified without a suffix)	RTV-159 (Red)	01139(B)
P09-018	Sealant		RTV DC 3145	71984
P09-019	Sealant, Silicone Rubber, Flame Resistant	PWA 36751-1	Dapocast No. 18-4F	58093 0JWE8 74230 S0076 74230
P09-020	Adhesive, Silicone Rubber, Single Component Type, Room Temperature (Superseded by PWA 36003-1)	PWA 616	RTV 106	01139(B) 74230 98500
P09-027	Sealant, Silicone Rubber	PWA 36003-2 (When PWA 36003 is specified without a suffix, use P09-014)	RTV-157 (Gray)	01139(B)
P09-029	Sealant, Silicone, Rubber	PWA 36029-1 (use when PWA 36029 is specified without a suffix)	Silicone Rubber Sealant Catalog No. 732 (Paste)	B1571 9A303
P09-034	Compound, Sealing	MIL-S-83430 Class A 1/2 PR-1750, Class A (Latest Revision)		LOCAL

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
P09-035	Compound, Sealing	MIL-S-83430 Class B 1/2 PR-1750, Class B (Latest Revision)		LOCAL
P09-036	Compound, Sealing	MIL-S-29574 Type I, Classes A and C (Latest Revision)		33564
P09-037	Sealant	MIL-S-38249 (Latest Revision)	Pro-Seal 700	83527
P09-038	Compound, Sealing		PR-1828, Class B-2	99891
P09-039	Compound, Sealing	MIL-S-8802 Type I, (Latest Revision)	PR-1422	99891
P09-040	Compound, Sealing Topcoat	MIL-S-4383 (Latest Revision)	PR-1005	99891
P09-041	Compound, Sealing		PR-1436-G, Classes A and B	99891
P09-042	Compound, Sealing		Loctite 518	05972
P11- CLEANING AGENTS				
P11-001	Solution, Cleaning		Bendix 25-1 Detergent (Mixed With De-Ionized Water)	99251
P11-002	(Deleted)			

NOTE : For wipe procedures, replace P11-002 with one of the solvents in SPOP208 (Ref. 70-00-00, P. Block 201).

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
	To clean wiring harnesses, replace P11-002 with SPOP6 (Ref. 70-00-00, P. Block 201).			
P11-003	Kerosene	VV-K-211 PMC 9021		LOCAL
P11-004	Solvent, Cleaning	PMC 9010 140°F (60°C) Flash Point	ARDROX 5412	D1940 S0178 02CA7 23373
			SAFETY-KLEEN Premium Solvent #6605	30530
			Solvent 142 3 percent Aromatics Maximum	34897
P11-005	Solvent, Methyl Ethyl Ketone (MEK)	TT-M-261 : PMC 9076	Technical Grade	LOCAL
P11-005A	Solvent, Methyl Ethyl Ketone (MEK)	PMC 1820	Reagent Grade	LOCAL
P11-006	(Deleted)	(Use P11-014)		
P11-007	Solvent, Chlorothene NU	O-T-620		71984
P11-008	Compound, Cleaning		AC Type 2 or Equivalent	70040
P11-009	Alcohol, Denatured	PMC 9009 -1 Thru -6 Denatured Ethanol ; Specific Gravity 60/60F : 0.800-0.820 Flash Point :		LOCAL

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
		30°F (-1°C), minimum Boiling Range : Initial Boiling Point : 165°F (74°C), minimum 95% Over : 175°F (79°C), maximum Water : 5.0%, maximum Vapor Pressure at 68°F (20°C) : 45 mm Hg, maximum		
		PMC 9009-7	A405P-4	1KGE8
NOTE : Do not denature with methanol.				
P11-011	Ethyl Acetate	TT-E-751		LOCAL
P11-013	Trichloro-ethylene	O-T-634, Type II : PMC 9004	Trichlor-ethylene	96717
P11-014	Alcohol, Isopropyl	PMC 9094	Technical Grade, 99% minimum: (Liquid)	LOCAL
			# 1001-0911 (Saturated Wipers)	S0210
			SW420034 (Pre-(Saturated Wipers)*	0M3C8
			R-503 (Aerosol)	98733

NOTE : * Must obey the requirements of the latest issue of AMS 3819 (Cloths,

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
	Cleaning for Aircraft Primary and Secondary Structural Surfaces).			
P11-014A	Alcohol, Isopropyl	(P11-014A is deleted. Refer to P11-078)		
P11-015	Cleaner, Alkaline Aluminum		Dirl-Lum 603	98079
P11-016	Slurry		Sol 795	B0004
P11-017	Solvent		Oakite 33	02CA7
P11-021	Cleaner, Gaspath	SPMC 87-1 (Deleted. No longer Available)	*Ardrox 6343	
	*Solvent -Type ; **Detergent -Type (recommended in place of solvent-type products for environmental reasons)	SPMC 87-2 (Deleted. No longer Available)	**Ardrox 6345	
		SPMC 87-3 (Deleted. No longer Available)	*Ardrox 252-L	
		SPMC 87-4	*B & B 3100	21361
		SPMC 87-5	**B & B TC100	21361
		SPMC 87-6	*Cee-Bee R-674	71361
		SPMC 87-7	*Penair M5704A	56883
		SPMC 87-8	(Deleted)	
		SPMC 87-9A	**ECT R-MC (Part No. 4070 Pre-Mixed)	S0141

	ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
			SPMC 87-9B	**ECT R-MC (Part No. 4072 Concentrate)	S0141
			SPMC 87-10A	**ARDROX 6367	D1940 K6858 02CA7 23373
			SPMC 87-10B	**ARDROX 6368	D1940 K6858 02CA7 23373
			SPMC 87-11A	**Turco 6783-3	71410
			SPMC 87-11B	**Turco 6783-10	71410
			SPMC 87-11C	**Turco 6783-50	71410
			SPMC 87-12	*Turco T-5884	71410
			SPMC 87-13	**ZOK 27	1NCU0 U4628
			SPMC 87-14	**Turbo-K	S0170
R	P11-027	Solvent, Stoddard Petroleum	PMC 9001, MIL-PRF-680B Type I, -OR- MIL-PRF-680B Type II -OR- MIL-PRF-680B Type III	Flash Point, TCC 100 - 140°F (38 - 60°C) Flash Point, TCC 141 - 198°F (61 - 92°C) Flash Point, TCC 200 - 241°F (93 - 116°C)	LOCAL
	P11-031	Cleaner,	PMC 1284	Blue Gold	0GA37

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
	Alkali (General Cleaner)		Industrial Cleaner	
P11-032	Acetone, Phenol-free	PMC 9008-1, -2,-5,-6,-7		LOCAL
		PMC 9008-3,-4	R-504 (Aerosol)	98733
		PMC 9008-8	SW420053 # 1003-0911 (Presaturated Wipers)	OM3C8 S0210

NOTE : Do not use P11-032 for bonding applications where reagent-grade solvent is required. For those applications, P11-065 must be used.

P11-037 (Deleted).

P11-038 (Deleted).

NOTE : Replace P11-038 with one of the solvents in SPOP208 (Ref. 70-00-00, P. Block 201).

P11-039	Solvent, Cleaner	PMC 9060	DeSoClean 45 Solvent Cleaner	23354
P11-040	Cleaner, Alkali	SPMC 106	Blue Gold Spray Washer	OGA37
P11-041	(Deleted)	SPMC 107		

NOTE : Replace P11-041 with one of the solvents in SPOP209 (immersion method) (Ref. 70-00-00, P. Block 201).

P11-042	Cleaner/ Remover, Fluorescent Penetrant	PMC 4366	Magnaflux SKC-S	37676
P11-043	Solvent, Methyl Isobutyl Ketone (MIBK)	PMC 9079 Technical Grade		LOCAL
P11-044	Cleaner, Alkali	SPMC 104	Cee-Bee A-7X7	71361

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
P11-045	Cleaner, Alkali	SPMC 105	Turco 5948 DPM	71410
P11-046	(Deleted)			
P11-047	Cleaner, Alkali Gel	SPMC 109	Turco 5948 DPM Thick	71410
P11-048	Cleaner, Alkali Gel	SPMC 110	Aviawash Green Gel	D1940 S0178 02CA7 23373
P11-049	Cleaner, Aqueous	SPMC 148-1	Turco 6780 ECO-SOLV	71410
		SPMC 148-2	Ardrox 6077 Window Cleaner Plus	D1940 K6858 02CA7 23373
		SPMC 148-3	MAG-CHEM Evasol	35502
		SPMC 148-4	MC Spray & Wipe	0GA37
P11-050	(Deleted)			
P11-052	Cleaner, Heavy Duty		CALLA 855	8E913
P11-053	Alkali Gel	SPMC 135	Dubois AE-3003	72008
		SPMC 136	Turco 5805	0BYN5
		SPMC 137	Cee-Bee Alko	71361
P11-054	(Deleted)			
P11-055	Solvent, Cleaner	PMC 8914 PMC 8914-1 : Aerosol PMC 8914-2 : 1 Gallon (3.79 liter) Container	Envirosol 655	05867
P11-056	Solvent, Cleaner	SPMC 156	MAG-CHEM TekSol	35502

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
P11-057	Solvent, Cleaner	SPMC 168	Aviation C.I.C Remover	023V4
P11-058	Solvent, Cleaner	SPMC 175	Quantum 2000 (CE-SX-94)	86938
P11-059	Solvent, Cleaner	SPMC 176	Isoblast (GB-SX-94)	86938
P11-060	Solvent, Cleaner	SPMC 179	CRC Precision Plus Cleaner	023V4
P11-062	Solvent, Dielectric (Ultra-high Purity)	PMC 8920	Positron	0WU71
P11-063	Solvent, Hand-wiping	PMC 8917	EZE 662	78304
P11-064	Solvent, Cleaner	SPMC 185	Cynergy (L-SX-94)	86938
P11-065	Acetone	PMC 1914	(Reagent Grade, A.C.S) (Liquid)	LOCAL 0AL61
			JT Baker 9006-05 (Liquid)	70829
			PC0048A-3	1HX90
			SW420030 # 1004-0911 (Pre-saturated Wipers)	0M3C8 S0210
			TX8346	S0207
			AX0116	0AL61

NOTE : It is permissible to substitute Semiconductor grade acetone for reagent grade. Semiconductor grade is a higher purity chemical.

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
P11-066	Solvent, Hand-wiping	PMC 8929	Bioact 105, Precision Cleaner	0WUA8
			Bioact 105, Pre-Saturated Wipes	0WUA8
P11-068	Enhancer, Electrical Contact	SPMC 205	Stabilant 22	38948
P11-069	Cleaner, Alkaline Gel	SPMC 112	Ardox 1900B	D1940 S0178 02CA7 23373
P11-070	Cleaner, Alkaline Gel	SPMC 159	McGean-Rohco Super Bee 262	71361
P11-071	Cleaner, Aqueous	SPMC 113	Mag-Chem DG Kleen	35502
P11-072	Degreaser, Aqueous	SPMC 151	Nu-Gear-SC	1EYE7
P11-073	Degreaser, Aqueous	SPMC 195	Mirachem 500	63247
P11-074	Solvent, Cleaner	SPMC 213	Skysol Wipe Solvent	35502
P11-078	Alcohol, Isopropryl	PMC 9016 (all dashes except -7 -11,-12)	Reagent Grade, or Semiconduct grade : (Liquid)	LOCAL
		PMC 9016-7	SW420078 # 1002-0911 (Pre-satured Wipers)	0M3C8 S0210
		PMC9016-11	TX8347	S0207
		PMC9016-12	PX1834	0AL61

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
NOTE : It is permitted to substitute semiconductor grade isopropryl alcohol for reagent grade. Semiconductor grade is a higher purity chemical.				
P11-079	Degreaser, Aqueous	SPMC 170	Ardrox 6333A	D1940 K6858 02CA7 23373
P11-080	Degreaser, Aqueous	SPMC 181	Cee-Bee Super Bee 300LF	71361
P11-081	Cleaner, Aqueous	SPMC 207	Ardrox 6376	D1940 K6858 02CA7 23373
P11-082	Degreaser, Aqueous	SPMC 173	Cee-Bee Super Bee 300LFG	71361
R P11-083 R	Cleaner, Aqueous	SPMC 233	Aqua Vantage 3887 GD	94058
P15- STORAGE PRESERVATION				
P15-001	Dehydrating Agent (Desiccant)		MIL-D-3464 SPMC 214	LOCAL
P15-002	Coating Peelable		AZ 534-2B	0A3C8
P16- STRUCTURE PAINTS				
P16-001	Thinner		TL-29	98502
P16-002	Catalyst		Catalyst X-304	98502
P16-003	Base, Gloss, Black		443-3	98502
P16-004	Paint, (Red-Color No. 11136)		MIL-PRF -85285, Type I, FED STD-595	LOCAL
P18- PRIMER				
P18-001	Primer, Epoxy			71191

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
	Polyamide			
P18-001A	Primer, Epoxy Chemical And Solvent Resistant	MIL-P-23377F Type I, Class 1 (Latest Revision)		71191
P18-003	(Deleted. Use P18-023)	AMS 3110 (Superseded by AMS 3117)		
P18-007	Primer, Silicone	PWA 36086-2	Dapco No. 1-100	58093
P18-009	Primer, Silicone Rubber (Red or Clear)	PWA 556	DC-1200	71984 98500
P18-010	Primer, Adhesive	PWA 36055	SS 4004	01139(B)
P18-011	Primer, Urethane Compatible	(Deleted)		
P18-012	Primer, Epoxy Resin		463-12-8	98502
P18-013	Primer, Epoxy, Adhesive		BR-127	07542
P18-015	Primer, Epoxy (Replaced by P18-016)		Base 463-6-27 Converter X337 Thinner TL52-66	98502
P18-016	Primer, Epoxy (Green)		Base 10P4-2 Catalyst EC117	0KXA5 H0951
P18-018	Primer, Epoxy, Corrosion Inhibiting	PWA 36515	44-GN-36 (Preferred) or 44-GM-54	33461

ITEM No.	DESIGNATION	SPECIFICATION	USAGE	CODE SUPPLIER
P18-020	Primer, Epoxy	PWA 36519-1 (Green)	EEAE 152A/B Eco-prime	23354
		PWA 36519-2 (Black)	EWAE 118A/B Eco-prime	23354
P18-023	Primer, Zinc Mobybdate	AMS 3117	(Light Yellow)	LOCAL 77672
	TT-P-645B			LOCAL OW199 77672
P18-024	Primer, Epoxy Room Temperature Curing - Chromate Free, Low Volatile Organic Compound Content	PWA 36568	Primer Base (IP-714A) Base) Curing Solution (IP-714B Catalyst)	00BB6

B. Supplier Source Code List
(1)Reason for the job
(a)This list is an index of suppliers for consumable materials and for some specific equipment.
(2)Supplier code address list
(a)The addresses of the material manufacturers are included in alphanumerical order in the table that follows.
NOTE : All SOURCE CODES, except those in the S-series, refer to CAGE (Commercial and Government Entity) codes. The present CAGE code numbers were formerly called FSCM (Federal Supply Code for Manufacturers) and FSCNM (Federal Supply Code for Non-Manufacturers) codes. The actual five-digit codes assigned to companies as FSCMs or FSCNMs have remained the same but have been redesignated as CAGE codes. All SOURCE CODES in the
R S-series (that is, S0001 thru S0233) are assigned by P&W to those consumable material suppliers that have no CAGE code.

Supplier Code	Name/Address
A0001	(Refer to LOCAL)
A0014	(Refer to 12861)

Supplier Code	Name/Address
A0056	(Refer to S0029)
A0285	(Refer to 98500)
A0290	(Refer to 95015)
A0292	(Refer to 97361)
B0004	Product Sol, Inc. - Birmingham, MI (Current Address Unavailable)
B0006	(Refer to 93255)
B0007	(Refer to OBYN5)
B0008	Products Research & Chemical Co. - Gloucester, NJ (Current Address Unavailable)
B0009	Paul & Co. - Steinhau, Germany. (Refer to S0119)
B1050	Antwerp Lion Oil Works N.V. VLAMSE KAAI 2-5 Antwerpen, Belgium
B1571	Dow Corning S.A. Parc Ind. Zone C Seneffe, Belgium
C4298	Pruftechnik Dieter Busch AG Oskar-Messter-Strasse 19 to 21 Postfach/P.O. Box 1263 D-85737 Ishmaning, Germany
D1940	Chemetall GmbH Trakehner Strasse 3 D-60487 Frankfurt am Main, Germany
EQ032	Foucault International Corp. 920 36th Court SW Vero Beach, FL 32968 USA
F0351	(Deleted)
F1419	International Celomer 75BD Winston Churchill 76052 Le Havre Cedex, France

Supplier Code	Name/Address
F6662	BSB France SA 3 R Du Mal De Lattre De Tassigny 78150 Le Chesnay, France
H0951	Akzo Dexter Aerospace Finishes RIJKSSTRAATWEG31 P.O. Box 3 Sassenheim, Netherlands 2170BA
K1636	AMPS Inc. of Great Britain Ltd. Terminal House Merrion Ave. Stanmore (London) Middlesex HA7 4RS England
K2063	Ely Chemical Co., Ltd. Lisle Lane Ely CB7 4A5, United Kingdom
K2884	(Refer to D1940)
K6858	(Refer to D1940)
LOCAL	Local Purchase
S0001	Refer to Service Bulletin SB 238
S0004	(Deleted. Refer to 86874)
S0005	(Deleted)
S0006	(Refer to S9502)
S0007	(Refer to 08FS3)
S0008	(Refer to 0XB37)
S0018	(Refer to 94499)
S0020	(Refer to 027L3)
S0025	(Refer to 1A319)
S0027	(Refer to 0GA37)
S0029	National Tape Corp. 5140 Storey Street New Orleans, LA 70123-5320 USA
S0036	Texrite Products Co.

Supplier Code	Name/Address
	10333 Shoemaker Street Detroit, MI 48213 USA
S0055	Mosher Co., Inc. 15 Exchange Street Chicopee, MA 01014 USA Or P.O. Box 177 Chicopee, MA 01014-0177 USA
S0045	(Refer to 23037(D))
S0057	(Refer to 05972)
S0066	(Refer to B1571)
S0075	(Refer to 1TGF9)
S0076	(Refer to 0JWE8)
S0077	(Refer to 35502)
S0078	(Refer to 23373)
S0083	(Refer to 1M647)
S0092	(Refer to 72008)
S0099	TTI (Was : Tesa Tape, Inc.) 5825 Carnegie Boulevard Charlotte, NC 28209 USA
S0101	Power in Motion 16A Montesano Road Fairfield, NJ 07004 USA
S0109	(Refer to 4G117)
S0113	(Refer to 0V0Z6)
S0117	Rhodia VSI (Was : Rhone-Poulenc Silicone VSI) 405 Jordan Road Troy, NY 12180 USA
S0118	G.K.D. Kufferath & Co. P.O. Box 101155 Metallweberstrasse 46

Supplier Code	Name/Address
	5160 Duren, Germany
S0119	Paul GmbH & Co. P.O. Box 1228 Industriegebiet West 36396 Steinau an der Strasse, Germany
S0126	Eishin Kagaku Co., Inc. 1-2-13, Higashi-Shinbashi Minato-Ku Tokyo, Japan-105
S0141	ECT, Inc. Bridgeport Business Park 401 East 4th St., Building 20 Bridgeport, PA 19405 USA
S0144	Carco, Inc. P.O. Box 13859 10333 Shoemaker Street Detroit, MI 48213 USA
S0150	(Refer to 70362)
S0156	(Refer to 1ZC62)
S0163	Polyflow, Inc. 100 Pratt's Junction Road Sterling, MA 01564 USA
S0170	Turbo-K, Ltd. 31 Meadow Close London Colney AL2 1RH, England
S0175	Hankuk Fiber Glass Co., Ltd. Miryang KyungNam South Korea
S0176	Tyco Adhesives, A Tyco International Ltd. Co. 1400 Providence Highway Norwood, MA 02062-5044 USA
S0178	Chemetall Plc Denbigh Road Bletchley Milton Keynes,

	Supplier Code	Name/Address
		MK1 1PB, United Kingdom
	S0210	Telesto Industrie, LLC 3718 Highway 90 Liberty, TX77575
	S0212	Sonneborn, LLC 575 Corporate Drive Suite 415 Mahwah, NJ 07430 USA
	S0214	C-E Minerals 901 East 8th Avenue King of Prussia, PA 19406 USA
R	S0216	Momentive Performance Materials, Inc. Corporate Headquarters 22 Corporate Woods Boulevard Albany, NY 12211 USA
	S0226	JacksonLea (A Unit of Jason, INC.) 1715 E. Conover Boulevard Conover, NC 28613 USA
R	S0233	Unilever United States, Inc. 800 Sylan Avenue Englewood Cliffs, NJ 07832 USA
	S9502	Marktec Corp. 3-10, Sanno 2-Chome OHTA-KU Tokyo, Japan
	U0419	Glenair International Limited Park Works, Park Road Mansfield Notts NG19 8EF England
	U0425	Pyle-National Ltd. Sherbrook Road Daybrook Nottingham NG5 6AT England
	U0638	(Refer to K2063)
	U4628	Airworthy, Ltd. Elsted Station Elsted, Midhurst

Supplier Code	Name/Address
	West Sussex, GU29 0JT United Kingdom
0AG11	Aviation Fuids Service, Inc. 950 Kingsland Avenue P.O. Box 2489 St. Louis, MO 63130 USA
0A290	(Deleted)
0A291	(Refer to 97361)
0AL61	EMD Chemicals, Inc. 480 Democrat Road Gibbstown, NJ 08027 USA
0AH54	(Deleted)
0A3C8	AZTEC Chemical Inc. 10770 Lower AZUSA Rd. El Monte, CA 91731 USA
0A307	Jet Lube Inc. Sub. of Capitol Southwest Corp. 4849 Homestead Rd. Houston, TX 77028 USA
0A341	Strahl And Pitsch Inc. 230 Great E. Neck Rd. P.O. Box 1098 West Babylon, New York 11704 USA
0BYN5	(Refer to 71410)
0CZA6	Hercules Aerospace Co. 5000 S. 8400 W. P.O. Box 98 Magna, VT 84044-0098 USA
0ER09	American Marking Systems Inc. 2741 Paxton Street Harrisburg, PA USA 17111-1030
0EWP0	Garvey 871 Redna Terrace Cincinnati, OH 45215 USA
0GA37	Modern Chemical Inc. 7023 Centennial Rd.

Supplier Code	Name/Address
	P.O. Box 368 Jacksonville, AR 72078 USA
OJWE8	Adchem, Inc. 369 Progress Drive Suite 101 Manchester, CT 06040-2296 USA
OJWS4	Aprol Petroleum Co. 2210 Hackberry Lane P.O. Box 3087 Conroe, TX 77305-3387 USA
OJYZO	SCI Corporation 812 East Broadway Streator, IL 61364 USA
OKHE3	3M/Aerospace Materials Department 3211 East Chestnut Expressway Springfield, MO 65802-2592 USA
OKXO5	Bayside Industrial Supply, Inc. 4663 Halls Mill Road P.O. Box 91566 Mobile, AL 36691 USA
ONOL1	(Refer to 23373)
ONYS9	(Refer to 23354)
OPGK2	S D B Consultants LTD 401 Whitney Avenue, Suite 120 Gretna, LA 70056-2500 USA
ORTX7	RM Engineering Products Inc. - North Charleston, SC (Current Address Unavailable)
OS4B8	(Deleted)
OVB34	Taconic Plastics, Ltd. Taconic Process Materials Div. 3070 Skyway Drive Bldg. 502 Santa Maria, CA 45241 USA
OVOZ6	Videojet Technologies, Inc. (Was : Marconi Data Systems, Inc.) 1500 Mittel Boulevard

	Supplier Code	Name/Address
		Wood Dale, IL 60191-1073 USA
	0WU71	Ecolink, Inc. (Was : Div. of Sentry Chemical Co., Inc.) 1481 Rock Mountain Boulevard Stone Mountain, GA 30083-1505 USA
	0W199	The Sherwin-Williams Company 2390 Arbor Boulevard Dayton, OH 45439 USA
	0XB37	Van Waters & Rogers, Inc. 3002 F Street P.O. Box 7900 Omaha, NE 68107-0900 USA
	0YMU2	Daubert Chemical Co., Inc. 4700 S. Central Avenue Chicago, IL 60638 USA
R	0ZDB5	Airgas, Inc.
R		4692 Valentine Road
R		Ventura, CA 93003 USA
	00BA9	Penreco, Div. of Pennzoil - Quaker State Co. 138 Petrolia Street Karns City, PA 16041-9799 USA
R	00BB6	Indestructible Paint, Inc.
R		1 Independence Drive
R		Monroe, CT 06468 USA
	00046	(Deleted. Refer to 0ER09)
	00741	BOC Gases (Was : Airco Industrial Gases, Div. of The BOC Group) 575 Mountain Avenue Murray Hill, NJ 07974-2006 USA
	00768	Western Filament, Inc. 630 Hollingsworth Street Grand Junction, CO 81505 USA
	00779	AMPS, Inc. 2800 Fulling Mill P.O. Box 3608

Supplier Code	Name/Address
	Harrisburg, PA 17105 USA
01139	Momentive Performance Materials, Inc. (Bought out General Electric Co., Rubber & Fluid Products Dept.) 260 Hudson River Road Waterford, NY 12188 USA
01139(A)	(Sold. Refer to 01139)
01139(B)	(Sold. Refer to S0216)
012L8	Chemsol Inc. 8423 Boettner Road Bridgewater, MI 48115 USA
02CA7	Chemetall Oakite (Was : Oakite Products Inc.) 50 Valley Road Berkeley Heights, NJ 07922 USA
02SG7	Octel America, Inc. 200 Executive Drive Newark, DE 19702 USA
02ZK3	(Refer to 1NCU0)
023V4	CRC Industries, Inc. 885 Louis Drive Warminster, PA 18974 USA
02570	Swagelok Co. 29500 Solon Rd. Solon, OH 44139-3492 USA
02697	Parker-Hannifin Corp. O-Ring Div. 2360 Palumbo Drive P.O. Box 11751 Lexington, KY 40512-1751 USA
027L3	Emerson & Cuming Composite Materials, Inc. (Was : Emerson & Cuming, Inc. Div. of W. R. Grace & Co. Grace Syntactics) 59 Walpole Street Canton, MA 02021 USA

	Supplier Code	Name/Address
	03251	Macalaster Bicknell Co. of Conn. Inc. 181 Henry Street New Haven, CT 06510 USA
	03530	American Gas & Chemical Co. Ltd. 220 Pegasus Ave. Northvale, NJ 07647-1904 USA
R R R	04347	Henkel Corporation 211 Franklin Street Olean, NY 14760 USA
	04457	Mark-Tex Corp. 160 West Forest Ave. Englewood, NJ 07639 USA
	04552	Emerson & Cuming Specialty Polymers (Was : Grace W.R. and Co. Emerson and Cuming Dewey and Almy Chemical Div.) 869 Washington Street Canton, MA 02021-2513 USA
	04621	Hexcel Corp. 2350 Airport Fwy., Suite 550 Bedford, TX 76022-6027 USA
	04622	CYTEC Engineered Materials, Inc. (Was : BASF Corp.) 1440 N. Kraemer Blvd. Anaheim, CA 92806 USA
	047D8	Zyvax, Inc. 1388 NW 2nd Avenue Suite 5 P.O. Box 825 Boca Raton, FL 33429-0825 USA
	04963	3M Company Tape And Specialties Div. 3M Center, Bldg. 220-7E-01 St. Paul, MN 55144-1000 USA
	05045	The BG Service Co., Inc. 1400 Alabama Avenue - Suite 15 P.O. Box 2259 West Palm Beach, FL 33401 USA

Supplier Code	Name/Address
05160	Michigan Dynamics Inc. Garden City, MI (Current Address Unavailable)
05867	Fine Organics Corp. 205 Main St. P.O. Box 687 Lodi, NJ 07644-0687 USA
05972	Henkel Loctite Corp. (Was : Loctite Corp. ; Permatex Industrial Div. Of Loctite North America Group ; and, Loctite VSI. Inc.) 1001 Trout Brook Crossing Rocky Hill, CT 06067-3582 USA
06324	Glenair, Inc. 1211 Air Way Glendale, CA 91201 USA
06565	Norton Co. (for domestic orders) Coated Abrasive Div. Tenth Avenue & 25th Street Watervliet, NY 12189 USA or P.O. Box 808 Troy, NY 12181 USA
07096	Burke Industries (Was : Burke Rubber Co., Purosil Div. 13767 Freeway Drive Santa Fe Springs, CA 90670 USA
07098	Praxair - Industrial Gases (Was : Union Carbide Corp., Linde Div.) 175 E. Park Drive P.O. Box 44 Tonawanda, NY 14151-0044 USA
07099	Flexfab Molded Products (Was : Moxness Molded Products) (Was : Moxness Products, Inc.) 2030 Young Street East Troy, WI 53120 USA
07314	Fiberite Corp. - Winona, MN

Supplier Code	Name/Address
	(Obsolete)
07512	Saint-Gobain Performance Plastics 150 Dey Road Wayne, NJ 07470 USA
07542	CYTEC Engineering Materials (Was : CYTEC Fiberite, Inc. ; and, American Cyanimide Co. Industrial Chemical and Platics Div. Bloomingdale Dept.) 1300 Revolution Street Havre De Grace, MD 21078-3800 USA
07696	Kodak Canada, Ltd. 3500 Eglinton Avenue W Toronto M6M 1V3, Canada
07950	Anderol, Inc. (Was : Royal Lubricants Co., Inc.) 215 Merry Lane P.O. Box 518 E. Hanover, NJ 07936-0518 USA
08FS3	Vulcan Chemical Technologies (Was : Vulcan Chemicals, Div. of Vulcan Materials Co.) 1200 Urban Center Drive Birmingham, AL 35242 USA
09421	Empire Plastics, Inc. 521 Fairmont Avenue Endicott, NY 13760-5944 USA
09785	AGA Gas, Inc. 3300 Lakeside Avenue Cleveland, OH 44114-3751 USA
1A053	AAA Aircraft Supply Co. 36 Suffield Street P.O. Box 411 Windsor Locks, CT 06096-1320 USA
1A319	Lamart Corp. 16 Richmond Street Clifton, NJ 07011-2829 USA
1CXA3	Sefar America Inc.

	Supplier Code	Name/Address
		111 Calumet Street Depew, NY 14043-3734 USA
R	1E1X8	Saint-Gobain Ceramics & Plastics Inc. (DBA Saint-Gobain Ceramic Materials) 1 New Bond Street P.O. Box 15137 Worcester, MA 01615-0137 USA
	1EYE7	Nuvite Chemical Compounds 213 Freeman Street Brooklyn, NY 11222-1404 USA
R	1GD26	Aimtek Inc. 201 Washington Street Auburn, MA 01501-3224
	1HX90	Brand-Nu Laboratories Inc. 377 Research Parkway Meriden, CT 06450-7155
	1KGE8	Fisher Scientific Company Global Exports 3970 Johns Creek Court, Suite 500 Suwanee, GA 30024-1297 USA
	1ML15	Octel Starreon, LLC 8375 S. Willow Street - 5th Floor Littleton, CO 80124 USA
	1M647	Fuchs Lubricants Co. 281 Silver Sands Road P.O. Box 328 East Haven, CT 06512-4140 USA
	1NCU0	Zokman Products, Inc. 1220 E. Gump Road Fort Wayne, IN 46845-9794 USA
	1PWD8	Exxon Mobil Corp. 3225 Gallows Road - Room 4W917 Fairfax, VA 22037 USA
	1UGB2	Air BP Lubricants Division of BP Products North America Inc. Parsippany, NJ 07054-4406 USA
	1TGF9	Ohio Industrial Lubricants, Inc.

Supplier Code	Name/Address
	250 Mahoning Avenue Cleveland, OH 44113 USA
1VJW7	Intertape Polymer Management Corp. 3647 Cortez Road West Bradenton, FL 34210-3169 USA
1V074	Sulflo, Inc. 1158 Erie Avenue. North Tonawanda, NY 14120-3507 USA
1V824	Northern Fiberglass Sales, Inc. 102 Tide Mill Road P.O. Box 2010 Hampton, NH 03842 USA
1XNT8	D Aircraft Products 1191 N. Hawk Circle Anaheim, CA 92807 USA
1ZC62	Valco Cincinnati, Inc. (Was : W. Canning, Inc.) 411 Circle Freeway Drive Cincinnati, OH 45246 USA
10009	RM Engineered Products, Inc. - North Charleston, SC (Current Address Unavailable)
11139	Deutsch Company Engineered Connecting Devices 700 S. Hathaway Municipal Airport Banning, CA 92220 USA
11770	(Refer to 8F024)
11851	Daniels Manufacturing Corp. 526 Thorpe Road Orlando, FL 32824-8133 USA
12474	Bel-Ray Co., Inc. 1201 Bowan Avenue Wall, NJ 07719 USA
12861	Intertape Polymer Group, Inc. (Was : Armak Co., Tape Div.) 317 Kendall Avenue Marysville, MI 48040-1911 USA

Supplier Code	Name/Address
13556	Cinch Connector 1500 Morse Ave. Elk Grove Village, IL 60007 USA
13868	Kano Laboratories, Inc. 1000 Thompson Lane Nashville, TN 37211-4101 USA
14283	Matrix Science, Inc. P.O. Box 3309 Torrance, CA 90503-3807 USA
15653	Fairchild Fasteners - Fullerton Operations (Was : Kaynar Manufacturing Co.) 800 S. State College Blvd. Fullerton, CA 92831-3004 USA
16193	(Obsolete)
16837	Miracle Power Products Corp. 1101 Belt Line Street Cleveland, OH 44109-2849 USA
16902	Simpson Electric Co., Simpson Instruments Div. 853 Dundee Avenue Elgin, IL 60120-3090 USA
16956	Avery Dennison (For Orders) (Was : Dennison Mfg. Co., Identification Systems Div.) 50 Pointe Drive Brea, CA 92821-3699 USA
17125	(Deleted)
17209	(Deleted)
17534	Alconox, Inc. (Was : Standard Scientific Supply Co.) Suite 200 9 E. 40th Street New York, NY 10016-0402 USA
17699	Weiler Brush Co. 1 Wildwood Drive RD 1 P.O. Box 149

Supplier Code	Name/Address
	Cresco, PA 18326 USA
18034	(Refer to : 02570)
18598	Miller-Stephenson Chemical Co. Inc. 55 Backus Avenue Danbury, CT 06813 USA
18873	E. I. duPont de Nemours and Co., Inc. 1007 Market Street P.O. Box 1635 Wilmington, DE 19899 USA
19135	Mobil Oil Co. Interstate 10 P.O. Box 3311 Beaumont, TX 77704 USA
19354	Daniel Gerard & Co., Inc. 5 Plain Avenue New Rochelle, NY 10801-2204 USA
19955	Maryland Rubber Corp. - Baltimore, MD (Obsolete)
2A851	John R. Lyman Co. 60 Depot Street Chicopee, MA 01013-1251 USA
2B975	Hexcel Corp. 1913 N. King Street Seguin, TX 78155-2115 USA
2E531	Dow Corning Corp. 2914 Patterson Street Greensboro, NC 27407 USA
2G152	(Deleted)
R 2H505	Timet Co., Div. Of R Titanium Metals Corp. Of America R (Cancelled without replacement) R (Current Address Unavailable)
2M749	SKF Industries, Inc. Bearing Group 1100 1st Avenue King of Prussia, PA 19406 USA

Supplier Code	Name/Address
2R128	Castrol Industrial Americas (Was : Castrol Industrial North America, Div. of Endurance Technology) 1001 West 31st Street Downers Grove, IL 60515-5509 USA
20696	Maryland Brush Co. 3221 Frederick Avenue Baltimore, MD 21229-3807 USA
21361	B & B Tritech, Inc. (Was : B & B Chemical Co., Inc.) 875 West 20th Street Hialeah, FL 33010-2310 USA
21405	Sherwin, Inc. 5530 Borwick Avenue South Gate, CA 90280-7402 USA
22527	Fisher Scientific Co. 2000 Park Lane Pittsburgh, PA 15275 USA
22819	Aviall Services, Inc. 2750 Regent Boulevard Dallas, TX 75261-9048 USA
22873	(Refer to 23354)
23037(A)	E.I. duPont de Nemours Co., Inc. Chemical And Pigments Dept. 1007 Market Street Wilmington, DE 19898 USA
23037(D)	E.I. duPont de Nemours Co., Inc. Fabric & Finishes Dept. 1007 Market St. Wilmington, DE 19898 USA
23354	PRC-DeSoto International, Inc. A PPG Industries Company 823 East Gate Drive Mount Laurel, NJ 08054 USA
23373	Chemetall Oakite 16961 Knott Avenue La Mirada, CA 90638-6015 USA

	Supplier Code	Name/Address
	24269	Schaefer Machine Co., Inc. 200 Commercial Drive Deep River, CT 06417 USA
	24802	Pelseal Technologies, LLC (Was : Pelmore Laboratories, Inc.) 401 Lafayette Street Newtown, PA 18940-2151 USA
	26057	TAFA, Inc. 146 Pembroke Road Concord, NH 03301-5706 USA
	26066	Minnesota Mining & Mfg. Co. Industrial Tape Div. (Obsolete. Refer to 04963)
	27674	(Refer to 86938)
	27732	Ensign Products Co., Inc. 3528 East 76th Street Cleveland, OH 44105-1510 USA
	28112	Minnesota Mining and Mfg. Co., Performance Materials Div. (Was : Performance Chemicals & Fluid ; and, Industrial Chemical Products Div.) 3M Center Building 223-06-S-04 St. Paul, MN 55144-0001 USA
R	28124	3M Co., Abrasive Systems Div. 3M Center Building 0223-06-N-01 Saint Paul, MN 55144-1000 USA
R	28139	(Refer to S0233)
	28506	(Refer to 00741)
	29700	(Refer to 1PWD8)
	3A487	(Refer to 97361)
	3DYZ1	Crompton Corp. (Was : Witco/A Crompton Business) 1 American Lane Greenwich, CT 06831 USA

	Supplier Code	Name/Address
	3EG53	ChevronTexaco Corp. (Was : Texaco, Inc.) 6001 Bollinger Canyon Road San Ramon, CA 94583 USA
	3F733	Cabot Corp. Cab-O-Sil Div. 700 East U.S. Highway 36 Tuscola, IL 61953 USA
R	3FJ16	Echo Engineering & Production Supplies
R		Inc.
R		(DBA Echo Supply)
R		54046 W 78 th Street
R		Indianapolis, IN 46268-4149 USA
	3U728	(Refer to 1PWD8)
	30119	Ideal Industries Inc. Becker Place Sycamore, IL 60178-2917 USA
	30530	Safety-Kleen Corp. 1301 Gervais Street - Suite 300 Columbia, SC 29201 USA
	30676	Lord Corp., Chemical Products Div. 2000 W. Grandview Boulevard Erie, PA 16514-0038 USA
	32988	(Deleted. Refer to S0163)
	33461	Deft, Inc. 17451 Von Karmen Avenue Irvine, CA 92614 USA
	33564	Henkel Loctite Corp. (Was : Dexter Corp. Dexter Adhesive & Coating Systems) P.O. Box 312 2850 Willow Pass Road Bay Point, CA 94565-0031 USA
	33629	The Kindt-Collins Co. 12651 Elmwood Avenue Cleveland, OH 44111-5911 USA
	33684	Stanley Home Products, Inc.

Supplier Code	Name/Address
	Industrial Div. 116 Pleasant Street East Hampton, MA 01027-1118 USA
33890	Vitta Corp. 7 Trowbridge Drive Bethel, CT 06801 USA
33970	Custom Brush Co. 444 Suffolk Drive Cherry Hill, NJ 08002-2007 USA
34227	Sandstrom Products Co. 224 South Main Street Port Byron, IL 61275 USA
34897	Ashland Chemical Co. A Div. of Ashland Oil, Inc. P.O. Box 2219 Columbus, OH 43216-2219 USA
34568	Tiodize Co., Inc. 5858 Engineer Drive Huntington Beach, CA 92649 USA
35502	Magnus Chemicals, Ltd. (Was : Mag-Chem, Inc.) 1271 Ampere Boucherville, Quebec, Canada J4B 5Z5 or Socomor Finishing Technologies Zone Industrielle du Prat R. P. 3707 56037 Vannes, Cedex, France
36023	(Cancelled. Refer to 19354)
36346	Praxair - Industrial Gases (Was : Union Carbide Corp.) Linde Div.) Old Ridgebury Road Danbury, CT 06817 USA
37676	Magnaflux Corp. Div. Of Illinois Tool Works, Inc. 3624 W. Lake Avenue Glenview, IL 60025 USA
37995	Burmah-Castrol Canada Ltd.

Supplier Code	Name/Address
	3660 Lakeshore Boulevard W. Toronto, Ontario, Canada M8W 1P2
38597	Lockheed Martin Corp. (was : Martin Marietta Corp. Aero And Naval Systems) 2323 Eastern Blvd. E-5 Baltimore, MD 21220-4207 USA
38948	D. W. Electrochemicals, Ltd. 97 Newkirk Road North, Unit 3 Richmond Hill Ontario L4C 3G4 Canada
39428	McMaster-Carr Supply Co. 600 County Line Road Elmhurst, IL 60126-2034 USA
4G117	BGF Industries, Inc. 401 Amherst Avenue P.O. Box 592 Altavista, VA 24517 USA
4L264	Fabric Development, Inc. 1217 Mill Street Quakertown, PA 18951-1127 USA
4N020	CCP Industries, Inc. (Was : Cleveland Cotton Products Co.) 670 Alpha Drive Highland Heights, OH 44143 USA
4PNW1	Rubber Stamps Unlimited, Inc. 334 South Harvey Plymouth, MI 48170 USA
R 44197	(Refer to 1E1X8)
44389	(Refer to 02CA7)
44926	Olympic Glove Co., Inc. 75 Main Avenue Elmwood Park, NJ 07407 USA
45255	Owens-Corning Fiberglas Corp. Fiberglas Tower - T/11 One Owens Corning Parkway Toledo, OH 45629-0001 USA

Supplier Code	Name/Address
45681	Parker Hannifin Corp. 6035 Parkland Boulevard Mayfield Heights, OH 44124 USA
45773	(Refer to 33970)
47695	PPG Industries, Inc. Chemical Group One PPG Place Pittsburg, PA 15272-0001 USA
49367	Pyle-National Co. 1334 N. Kostner Avenue Chicago, IL 60651-1420 USA
5D028	Dow Corning Corp. 3901 South Saginaw Road Midland, MI 48640 USA
5S938	Ashland, Inc. 5200 Paul Blazer Memorial Parkway Dublin, OH 43017 USA
5W425	Bostik, Inc. (Was : Emhart Corp., Bostik Div.) 211 Boston Street Middleton, MA 01949 USA
50744	Kirkhill-TA Company (DBA SFS Division) 300 E Cypress Street Bea, CA 92821-4007 USA
50907	(Replaced by 99167)
52152	Minnesota Mining And Mfg. Co. Industrial Tape And Specialities Div. 3M CTR St. Paul, MN 55144-1000 USA
53012	Coatings For Industry, Inc. 319 Township Line Road Souderton, PA 18964-1905
53100	Lockheed Martin Space Systems Co. Michoud Operations (Was : Lockheed Martin Corp. ; and, Martin Marietta Corp.) 13800 Old Gentilly Road - MS 2300 P.O. Box 29304

Supplier Code	Name/Address
	New Orleans, LA 70129-2218 USA
53912	Airtech International, Inc. 5700 Skylab Road Huntington Beach, CA 92647-2055 USA
54527	Shell Oil Company 1 Shell Plaza P.O. Box 2463 Houston, TX 77001 USA
54636	The Shervin- Williams Co., Krylon Products Group 101 Prospect Avenue Cleveland, OH 44115 USA
54916	Radiac Abrasives Inc. 1015 South College Avenue Salem, IL 62881-2428 USA
55596	Polymet Corp. 10073 Commerce Park Drive Cincinnati, OH 45246-1333 USA
56385	Ultrachem 900 Centerpoint Boulevard Newcastle, DE 19720 USA
56501	Thomas and Betts Corp. 920 Route 202 Raritan, NJ 08869-1420
56883	Penetone Corp. 74 Hudson Avenue Tenafly, NJ 07670 USA
57635	(Refer to 1PWD8)
58093	(Refer to 1XNT8)
58595	Pilot Corp. of America 60 Commerce Drive Trumbull, CT 06611 USA
58913	Sermatech International, Inc. 155 S. Limerick Road Limerick, PA 19468-1699 USA
59460	Pyramid Plastics, Inc.

	Supplier Code	Name/Address
		Tolber Div. 220 West 5th Street Hope, AR 71801-5212 USA
	59595	(Refer to 3EG53)
	6A670	3M, ITSD Aerospace (Was : Adhesives, Coatings & Sealers Div.) 3211 E. Chestnut Expressway P.O. Box 300 M Springfield, MO 65802-2548 USA
	60218	Graphite Products Corp. 5756 Sharon-Warren Road P.O. Box 207 Brookfield, OH 44403-9507 USA
	60890	Dewal Industries, Inc. 15 Ray Trainor Drive P.O. Box 372 Saunderstown, RI 02874 USA
	61637	Danbury Union Carbide Corp. 39 Old Ridgebury Road Danbury, CT 06817-0001 USA
R R R	62369	Flexcon Co., Inc. 1 Flexcon Industrial Park Spencer, MA 01562 USA
	62758	(Refer to 23354)
	63247	Mirachem Corp. 4645 W. McDowell Road - Unit 103 Phoenix, AZ 85035 USA
	63585	Wall Colmonoy Corp. 30261 Stephenson Hwy. Madison Heights, MI 48071 USA
	64220	Ruger Chemical Co., Inc. 83 Cordier Street Irvington, NJ 07111-4035 USA
	64972	WESGO Metals A Division of Morgan Advanced Ceramics/ The Morgan Crucible Co. plc.

Supplier Code	Name/Address
	2425 Whipple Road Hayward, CA 94544 USA
65483	Allied Resin Corp. Weymouth Industrial Park E. Weymouth, MA 02189-1699 USA
66442	Richmond Aircraft Products 13503 Pumice Street Norwalk, CA 90650 USA
66724	LPS Laboratories, Inc. 4647 Hugh Howell Road Tucker, GA 30085-5052 USA
70040	General Motors Corp. AC Rochester Div. (Was : AC Spark Plug, Div. of General Motors Corp.) 4800 S. Saginaw Street Flint, MI 48501-1360 USA
70079	Acheson Colloids Co. Div. of Acheson Industries, Inc. 1600 Washington Avenue P.O. Box 611747 Port Huron, MI 48061-1747 USA
70362	Dixon Ticonderoga Co. (World Headquarters) 195 International Parkway Heathrow, FL 32746 USA
70752	Deleted
70958	Bergen Cable Technologies, Inc. 343 Kaplan Drive Fairfield, NJ 07004 USA
71191	Kop-Coat, Inc. 5431 District Boulevard Los Angeles, CA 90040 USA
71361	McGean (Was : McGean, Cee-Bee Aviation Products; and McGean-Rohco, Inc./ Cee-Bee Chemical Div.) 2910 Harvard Avenue Cleveland, OH 44105-3010 USA

Supplier Code	Name/Address
71410	Henkel Surface Technologies 32100 Stephenson Hwy. Madison Heights, MI 48071 USA
71643	Saint-Gobain Performance Plastics, Inc. (Was : CHR Industries, Inc. An Armco Co.) 407 East Street New Haven, CT 06511 USA
71984	Dow Corning Corp. 2200 West Salzburg Road Midland, MI 48640-8531 USA
72008	DuBois Chemicals, Inc. (Was : Chemed Corp. DuBois Chemicals Div.) 255 E. 5th Tower Cincinnati, OH 45202 USA
73165	(Refer to 05972)
73168	Kidde - Fenwal (Was : Fenwal, Inc. Div. of Kidde, Inc.) 400 Main Street Ashland, MA 01721-2150 USA
73219	Fiske Brothers Refining Co. 129 Lockwood Street Newark, NJ 07105-4720 USA
73277	Houghton International, Inc. (Was : E.F. Houghton & Co.) P.O. Box 930 Madison & VanBuren Avenues Valley Forge, PA 19482 USA
74116	New England Electrical Wire Corp. 365 Main Street Lisbon, NH 03585
74230	FMI Paint & Chemicals (Was : FMI Chemical Corp.) 158 Hartford Road Manchester, CT 06040 USA
74291	Solo-Horton Brushes, Inc.

Supplier Code	Name/Address
	122 Summer Street Torrington, CT 06780 USA
75273	Witco Chemical Corp. Kendall/Amalie Motor Oil (Was : Kendall Refining Co. Div. of WITCO Chemical Co.) 77 N. Kendall Avenue P.O. Box 2000 Bradford, PA 16701-1726 USA
75364	(Deleted. Sells only to distributors. Refer to local art supply store for source.)
75437	EOE, Inc. 585 Fourth Street P.O. Box 177 Troy, NY 12181 USA
75554	(Deleted. Use SO226)
75668	Sherwin-Williams Co. 2390 Arbor Boulevard Dayton, OH 45439 USA
75957	LUDECA Inc. 1527 NW 89th Street Miami, FL 33172 USA
76071	MacDermid, Inc. 245 Freight Street Waterbury, CT 06702-1802 USA
76381	3M Company 3M Center - Building 225-3S-20 St. Paul, MN 55144-1000 USA
76541	Monsanto Co. 800 N. Lindbergh Boulevard St. Louis, MO 63167 USA
77163	(Refer to 1V074)
77359	(Refer to 75668)
77445	United Technologies Corp. Pratt & Whitney Large Commercial Engines Spare Parts

Supplier Code	Name/Address
	Sales 400 Main Street East Hartford, CT 06108-0969 USA
77490	Quaker Chemical Corp. Elm & Lee Streets Conshohocken, PA 19428 USA
77672	Randolph Products Co. Inc. 33 Haynes Circle Chiccopee, MA 01020 USA
77902	The Rohm and Hass Co. 100 Independance Mall West Philadelphia, PA 19106-2399 USA
78369	(Refer to 3DYZ1)
8E913	Zip-Chem Products 408 Pickering Drive Pinkerington, OH 43147-1367 USA
8F024	Everlube Products, (Was E/M) Div. of Morgan Advance Ceramics 100 Cooper Circle Peachtree City, GA 30269-3025 USA
8S927	(Refer to 0WU71)
80164	Keithly Instruments Inc. 28775 Aurora Rd. Cleveland, OH 44139
80769	Polyken Technologies, A Div. of The Kendall Co. (Was : The Kendall Co. Polyken Div.) 15 Hampshire Street Manfield, MA 02048 USA
80798	(Refer to 3F733)
80861	International Paper One Penn Plaza - Suite 2814 New York, NY 10119 USA
82110	Gudebrod, Inc. 274 Shoemaker Road

Supplier Code	Name/Address
	Pottstown, PA 19464 USA
82726	(Deleted)
83309	Electrical Specialty Co. - South San Francisco, CA (Current Address Unavailable)
83311	Simmonds Precision Engine Systems BF Goodrich Aerospace Norwich-Oxford Rd. P.O. Box 310 Norwich, NY 13815
83334	Tuck Industries, Inc. - New Rochelle, NY (Current Address Unavailable)
83527	(Cancelled. Replaced by 23354)
84063	(Refer to 71410)
84163	Borden, Inc. Chemical Div. 180 East Broad Street Columbus, OH 43215-3705 USA
85419	Binney and Smith, Inc. 1100 Church Lane P.O. Box 431 Easton, PA 18042-9010 USA
85570	(Refer to 23354)
85665	(Refer to 76071)
85932	Electrofilm, Inc. 25395 Rye Canyon Road Valencia, CA 91355 USA
86293	The Craftint Mfg. Co. P.O. Box 1568 Augusta, GA 30903 USA
86297	Cratex Manufacturing Co., Inc. 328 Encinitas Blvd. - Suite 200 Encinitas, CA 92024 USA
86460	Elf Atochem North America, Inc.

Supplier Code	Name/Address
	2000 Market Street Philadelphia, PA 19103-3222 USA
86874	Sanford Corp. 2711 Washington Boulevard Bellwood, IL 60104 USA
86938	Selig Industries 1420 Seaboard Industrial Boulvard Atlanta, GA 30318 USA
87187	(Refer to 84163)
88303	Phillips Process Co., Inc. 20 Magnolia Street Rochester, NY 14608-2931 USA
88597	Volger's Ink Manufacturers (Out of Business)
89524	Ondeo Nalco Co. 1 Ondeo Nalco Center Naperville, IL 60563-1198 USA
9A090	DuPont Company Electronics Department US Route 23, South DuPont Road P.O. Box 89 Circleville, OH 43113 USA
9A303	Dow Corning Corp. 760 Hodgenville Road Elizabethtown, KY 42701-9016 USA
9T904	Ashland Oil, Inc./Valvoline Div. Specialty Coatings & Lubricants Group (Refer to 5S938)
9X057	Technical Laminations & Coatings (Was : Custom Tapes, Inc.) 7125 Gunnison Street Harwood Heights, IL 60656-3830 USA
91342	AKZO Nobel Aerospace Coatings, Inc. (Was : Dexter Specialty Coatings) 1 E. Water Street Waukegan, IL 60085-5652 USA
92108	PRC-Desoto International Inc.

	Supplier Code	Name/Address
		5454 San Fernando Road Glendale, CA 91203
	92194	Alpha Wire Corp. 711 Lidgerwood Avenue P.O. Box 711 Elisabeth, NJ 07207-0711 USA
R	92469	(Deleted. Refer to S0233)
	93255	Micro Essential Laboratory 4224 Avenue H Brooklyn, NY 11210-3518 USA
R	94058	Brulin & Company, Inc. P. O. Box 270 2920 Dr. Andrew J. Brown Avenue Indianapolis, IN 46206 USA
	94129	Brookfield Wire Co. Route 9 - P. O. Box 248 Brookfield, MA 01506 USA
	94480	(Deleted. Refer to 1KEG8)
	94499	Dow Corning Corp. 42 Old Flanders Road Woodbury, CT 06798-2109 USA
	94548	Chevron Chemical Co. Agriculture Chemical Div. 575 Market Street San Francisco, CA 94119 USA
	94853	The Hubbard Hall Chemical Co. 563 South Leonard Street P.O. Box 790 Waterbury, CT 06708 USA
	95015	Marvel Oil Co., Inc. 331-337 N. Main Street Port Chester, NY 10573-3305 USA
	95643	(Deleted)
	96717	Dow Chemical Co. 2030 Willard H. Dow Center Midland, MI 48674-0001 USA

Supplier Code	Name/Address
97361	Unisource & Alco Standard Co. (Was : Chatfield Paper Co.) 21 Dodge Avenue North Haven, CT 06473 USA OR (Was : Rourke-Eno Paper Co.) 100 Helmsford Way Windsor, CT 06095-0740 USA
97460	(Refer to 23354)
97854	(Deleted)
98079	CVC Products, Inc 525 Lee Road Rochester, NY 14606-4236 USA
98148	ITW Dykem 805 East Old 56 Highway Olathe, KS 66061 USA
98500	AGC, Inc. 106 Evansville Avenue Meriden, CT 06450-5135 USA
98502	Akzo Coatings, Inc. Aerospace Finishes Div. 434 W. Meats Street Orange, CA 92665 USA
98733	Met-L-Chek Co. 1639 Euclid Street Santa Monica, CA 90404-3723 USA
98795	Dexter Corp. Dexter Crown Metro Aerospace Div. 31500 Hayman St. Hayward, CA 94544-7120 USA
99167	Hamilton Sundstrand Corp. (Was : Sundstrand Aviation Division of Sundstrand Corp. Aircraft Equipment Division) 4747 Harrison Avenue Rockford, IL 61125-7002 USA
99251	Bendix Corp. Instrument and Life Support Div. 2734 Hickory Grove Rd.

Supplier Code	Name/Address
	P.O. Box 4508 Davenport, IA 52808
99384	Vantico, Inc. (Was : Ciba-Geigy) 5121 San Fernando Road West Los Angeles, CA 90039-1011 USA
99742	Permacel Nitto Denko Co. (Was : Permacel, Div. Of Nitto Denko America ; and, Permacel, Div. of Johnson & Johnson) U.S. Highway 1 P.O. Box 671 New Brunswick, NJ 08903 USA
99891	Products Research and Chemical Corp. 5430 San Fernando Road Glendale, CA 91203 USA

1. General

A. Reason for the Job

(1) This procedure gives general information and definitions applicable to PWA 357 riveting.

B. General

(1) All the tasks in this chapter make up the PWA 357 Riveting Specifications.

(2) Most rivets are formed by the cold continuous squeeze method. This method uses hand tools, or hydraulic, or pneumatic machines to form the rivet head from a continuous squeezing operation. Special tools, anvils, and rivet sets are provided where necessary. The hydraulic cold riveter is generally preferred over the pneumatic riveter since it is capable of exerting greater pressure and, in some instances, must be used. Specific instructions for swaging, bucking, or hot forming of rivets, or the use of dimpled sheets or explosive rivets, will be included in the pertinent assembly publication.

(3) Rivets made of AMS 7223 aluminum alloy (icebox rivets) require special treatment before their use to eliminate cracking tendencies while forming. They must be solution heat treated at 900 - 920°F (482 - 493°C) for 20 - 30 minutes ; then immediately quenched in cold water. These rivets must then be stored in a freezer at temperature of 0 - -40°F (-18 - -40°C) until used.

(4) The appropriate Illustrated Parts Breakdown and/or the assembly instruction publication lists the correct replacement rivet for an assembly. The instructions contained herein may be used for the correct replacement of oversize rivets.

NOTE : Particular assembly requirements may dictate some modification of these requirements. Where a conflict exists between these requirements and the assembly instructions outlined in a specific engine manual, the specific engine manual must take precedence.

(5) Unless specified differently, use the specifications that follow in this section 70-22-16, for removal and replacement of riveted assemblies.

C. Definitions

(1) **BLIND BOLTS :** A blind bolt is a three-piece assembly consisting of a sleeve, (nutlike) expander and a core bolt, installed and set by the use of special tools from the side of the sheet on which the manufactured head of the sleeve is seated. The nut expands the sleeve. The core bolt is installed after installation of the sleeve.

CAUTION : **BLIND RIVETS MUST NOT BE DEGREASED OR SOLVENT WASHED AS THIS WILL REMOVE THE LUBRICANT.**

(2) **BLIND RIVETS :** Blind rivets are rivets installed and set (upset head is formed) from the side of the sheet on which the manufactured head is seated. They are multi-piece rivets which are set by pulling specially designed and integral pins (or stems) with special tools.

Depending on the particular type of blind rivet being used, the pin may be designed so as to break flush with, below, or above the top of the manufactured head, or the pin may be designed to be pulled completely through the shell of the rivet.

(3)**BURR COLLAR** : A burr collar is a thin irregular shaped ridge of material around a rivet hole that is the result of a machining or piercing operation.

(4)**COUNTER SURFACE** : The surface of the conical recess provided for countersunk head rivets. This surface may be produced by machining or dimpling.

(5)**FAYING SURFACES** : A surface that is in intimate contact with another surface ; a fitted surface.

(6)**IMPACTED BURR COLLAR** : An impacted burr collar is one that has been pushed away from the rivet hole or is caught by the rivet in the upsetting operation.

(7)**MACHINE COUNTERSUNK** : Procedure in which the holes are drilled through all sheets in one operation and the countersink depressions are made by a machine operation that cuts metal. Machine countersinks are normally contained in one sheet and do not extend into faying surfaces.

(8)**MANUFACTURED HEAD** : The head produced at the time the rivet is manufactured and before the rivet is installed in the assembly.

(9)**PROTRUDING HEAD RIVETS** : A protruding head rivet is any rivet that has the bearing surface of the head fit flat against the sheet and all of the head projects above the surface of the sheet. "Protruding Head" is a general term that includes button, brazier, cone, fillister, flat, mushroom, oval, pan round, steeple, tinners, truss, universal, or washer head shapes.

(10)**RIVET PIN** : A rivet with a circumferential groove or grooves on the end opposite the head. After the pin is installed, a collar or sleeve is swaged over the end of the pin and into the grooves performing the same holding action as the upset head on a conventional rivet.

(11)**ROTATING OR REVOLVING PART** : A part that rotates (turns) about its own axis or a part that is attached to a part that rotates around its own axis.

(12)**SHEET** : A metallic or plastic item, in which the rivet is installed that has been machined, forged, rolled, or molded to be thinner than its length and/or width.

(13)**STATIC PART** : A stationary part (that is, any item other than a rotating or revolving part).

(14)**UPSET HEAD** : The head produced at the time the rivet is installed in the assembly, sometimes called "bucked head".

(15)**WETTED SURFACE** : The surface of the sheet or part over which the fluid (such as, air) flows.

2. Rivet Types

A. Rivet Types

(1)The type of riveting or other related processes necessary in an assembly will be specified on the repair illustration or in the text by a dash

and a one-, two-, or three-digit suffix to this specification number (that is, PWA 357-X, PWA 357-XX, or PWA 357-XXX). If the requirements of PWA 357 and a specific Engine Manual do not agree, then use the requirements given in the Engine Manual.

(2)Type

Suffix	Rivet Type
1	Soft solid shank rivets (such as, AMS 7220, 7222, 7225, or 5056-H32 material)
2	Hard solid shank rivets (such as, AMS 5735, 5737, 7228, 7229, 7232, 7233, 7235, 7236, or 7237 material)
3	Soft solid shank icebox rivets (such as, AMS 7223 or 2017-T4 material)
4	Hollow or explosive rivets
5	Blind rivets
6	Lockbolt-pull type rivet pins
7	Lockbolt-stump and hi-shear stump rivet pins
8	Blind bolts and nuts
0	Qualification of source is no longer necessary ; the rivet suffix code "0" is kept here for older illustrations.

(3)Second suffix digit - riveting process

Suffix	Process
1	Cold upset heading
2	Hot upset heading
3	Spun or orbital upset heading
4	Cold or hot upset heading
5	Exploding.

(4)Third suffix digit - sheet preparation

Suffix	Preparation
1	Cold-form dimpling
2	Hot-form dimpling
3	Cold-coin dimpling
4	Hot-coin dimpling
5	Cold or hot-form dimpling
6	Cold or hot-coin dimpling
7	Press dimpling.

3. Rivet Symbols

A. Reason for the Job

(1) This procedure gives information on standard symbols used in PWA 357 Riveting instructions. It also gives an explanation of the information that you find in each of the quadrants in the rivet symbol.

B. General

(1) On rivet assembly illustrations, the rivet, head position, type of hole, counter surface requirements, etc. are specified by use of standard symbols. The symbol includes a single "cross" whose intersection or leader indicates the location of the fastener. The cross symbol has quadrants. Each quadrant contains specific information (Ref. Fig. 201).

C. Quadrant Identity

(1) Upper left quadrant (Ref. Fig. 201, 202)

(a) The rivet identity in the upper left quadrant is shown by part number (for example NAS1097DD) or by a letter code (for example MC). Letter codes and the specific part numbers are listed in Tables 201, 202, 203, and 204.

NOTE : Codes that start with X, Y or Z are only for PW use.

Protruding Head Conventional Rivets
Table 201

BASIC CODES	BASIC PART NUMBERS	SHANK MATERIALS	DESCRIPTION
AS	(Now LL)		
AT	(Now LN)		

BASIC CODES	BASIC PART NUMBERS	SHANK MATERIALS	DESCRIPTION
BH	MS20470A	1100-F	Rivet-Universal Head
BJ	MS20470AD	2117-T3	Rivet-Universal Head
BK	MS20470B	5056-F	Rivet-Universal Head
BL	MS20470D	2017-T31	Rivet-Universal Head (Ice-boxed)
BM	MS20470D	2017-T3	Rivet-Universal Head (Drive Hard)
BO	NAS508M	Monel	Rivet-Universal Head
CX	MS20470DD	2024-T31	Rivet-Universal Head
DF	(Now LM)		
HH	(Now LO)		
HX	(Now SH)		
LK	(Now LL)		
LL	MS20613-( ) P	Steel	Rivet-Universal Head, Cad. Plated
LM	MS20613-( ) C	Cres	Rivet-Universal Head
LN	MS20615-( ) M	Monel	Rivet-Universal Head
LO	MS20615-( ) CU	Copper	Rivet-Universal Head
MM	NAS1198	A286	Rivet-Universal Head
RM	ST1107	AMS 7234	Rivet-Blind, 0.188 Universal Head
RM	ST1108	AMS 7234	Rivet-Blind, 0.250 Universal Head
RM	NAS1398M		Rivet-Blind, Locked Spindle
RN	ST1086	AMS 5732	Rivet-Blind, 0.094 Universal Head
RN	NAS1398C	A286	Rivet-Blind, Locked Spindle
SH	MS20615-( ) MP	Monel Cad. Plate	Rivet-Universal Head
TL	ST1139	AMS 7234Ag	Rivet-Blind, 0.250 Universal Head

BASIC CODES	BASIC PART NUMBERS	SHANK MATERIALS	DESCRIPTION
TL	NAS1398MS	Monel	Rivet-Blind, Locked Spindle
WD	ST1265	AMS 4730	Rivet-Blind, 0.125 Universal Head
WD	NAS1919M	Monel	Rivet-Blind, Locked Spindle
WW	MS9319	AMS 7233	Rivet-Universal Head (was XF)
WX	MS9403	AMS 5737	Rivet-Universal Head (was XG)
ACW	ST1588	AMS 5731	Rivet-Blind, Grip, Universal Head
ACX	ST2618	AMS 5731	Rivet-Blind, Countersunk Head, 0.125, 0.156, 0.188, 0.250 Dia.
ACZ	ST1158	AMS 5698	Rivet-Blind, 0.156 Universal Head
ADB	ST1300	AMS 5687	Rivet-Blind, Universal Head
ADB	NAS1738C	Iconel	Rivet-Blind, Locked Spindle
AJH	ST2188	AMS 4951	Rivet, 0.164 Pan Head
AJH	ST2188	AMS 4967	Rivet, 0.164 Pan Head
APZ	NAS1242AD	Al Alloy	Rivet-Blind, Universal Head
ARG	ST1174	AMS 4730	Rivet-Blind, 0.140 Universal Head (was XAB)
ATM	ST1173	AMS 4730	Rivet-Blind, 0.125 Universal Head
ATM	ST1215	AMS 4730	Rivet-Blind, 0.156 Universal Head
ATM	ST1216	AMS 4730	Rivet-Blind, 0.188 Universal Head
AYZ	ST2490	AMS 5687	Rivet-Blind, Universal Head, 0.140, 0.173, 0.201, 0.267 Dia.
MAF	NA0003-( ) N	2117-T4	Rivet-Universal Head (Metric)

Countersunk Head Conventional Rivets
Table 202

BASIC CODES	BASIC PART NUMBERS	SHANK MATERIALS	DESCRIPTION
AX	ST1208	2117-T4	Rivet-Blind, 0.156 Countersunk Head
BA	MS20426A	1100-F	Rivet-100 dia. Countersunk Head
BB	MS20426AD	2117-T3	Rivet-100 dia. Countersunk Head
BC	MS20426B	5056-F	Rivet-100 dia. Countersunk Head
BD	MS20426D	2017-T31	Rivet-100 dia. Countersunk Head (ice-boxed)
BE	MS20426D	2017-T3	Rivet-100 dia. Countersunk Head (Drive Hard)
BF	MS20427M	Monel	Rivet-100 dia. Countersunk Head
BP	ST1225	See Desc.	Rivet-Blind, Countersunk (Ni-Cu/Steel)
CL	MS20427-( ) C	Steel	Rivet-100 dia. Countersunk Head
CR	ACT 509N-T	AMS 5732	Rivet-Blind, 0.156 Countersunk Head
CY	MS20426DD	2024-T31	Rivet-100 dia. Countersunk Head
DH	MS20427F	Cres	Rivet-100 dia. Countersunk Head
HF	MS20427C	Copper	Rivet-100 dia. Countersunk Head
HW	(Now AAD)		
LZ	NAS1097AD	2117-T4	Rivet-100 dia. Countersunk Head, Shear Head
MA	NAS1097B	5056-H32	Rivet-100 dia. Countersunk Head, Shear Head
MB	NAS1097D	2017-T4	Rivet-100 dia. Countersunk Head (Drive Hard)
MC	NAS1097DD	2024-T4	Rivet-100 dia. Countersunk Head, Shear Head
MK	NAS1097D	2017-T4	Rivet-100 dia. Countersunk Head, (Ice-boxed)

BASIC CODES	BASIC PART NUMBERS	SHANK MATERIALS	DESCRIPTION
MN	NAS1199	A286	Rivet-100 dia. Countersunk Head
MO	NAS1200	A286	Rivet-100 dia. Countersunk Head, Shear Head
RJ	ST2230	AMS 5732	Rivet-Blind 0.156 countersunk Head (Was CR)
WT	MS9318	AMS 7233	Rivet-100 dia. Countersunk Head (Was XR)
WV	NAS9460	AMS 7235	Rivet-100 dia. Countersunk Head
AAD	MS20427M( ) C	Monel	Rivet-100 dia. Countersunk Head Cad Plated
ADJ	ST1477	AMS 5687	Rivet-Blind 0.140 countersunk Head
AMT	ST1209	A286	Rivet-Blind 0.094 countersunk Head
ARF	ST1217	AMS 4730	Rivet-Blind 0.140 countersunk Head (Was XAC)

Protruding Head Propulsion Industry Rivets
Table 203

BASIC CODES	PART NUMBERS	MATERIALS	DESCRIPTION
XA	AN123151 thru AN123300	AMS 7229	Rivet-Universal Head
XB	AN123301 thru AN123450	AMS 7232	Rivet-Universal Head
XC	AN125401 thru AN125550	AMS 7228	Rivet-Universal Head
XD	AN125551 thru AN125700	AMS 7225	Rivet-Universal Head Cad. Plated
XE	AS125701 thru AS125850	AMS 7222	Rivet-Universal Head
XF	(Now WW. Refer to Table 201)		
XG	(Now WX. Refer to Table 201)		
XJ	ST1133	AMS 7237	Rivet-0.250, Universal Head
XJ	ST1219	AMS 7237	Rivet-Universal Head
XK	ST2223	AMS 4676	Rivet-0.125, Universal Head
XK	ST2224	AMS 4676	Rivet-0.156, Universal Head
XK	ST2225	AMS 4676	Rivet-0.188, Universal Head
XW	ST2213	AMS 5737	Rivet-Blind, Universal Head
XAA	(Now ATM. Refer to Table 201)		

BASIC CODES	PART NUMBERS	MATERIALS	DESCRIPTION
XAB	(Now ARG. Refer to Table 201)		
XAD	(Now WD. Refer to Table 201)		
XAE	ST1266	AMS 4730	Rivet-Blind, 0.140, Universal Head
XAM	AS3229	AMS 7228	Rivet-Tubular, Universal Head
XAN	AS3231	AMS 7232	Rivet-Tubular, Universal Head
XAR	ST1313	AMS 7237	Rivet-Tubular, Universal Head

Countersunk Head Propulsion Industry Rivets
Table 204

BASIC CODES	PART NUMBERS	MATERIALS	DESCRIPTION
ARD	ST1525		Rivet-Blind, 0.140 Countersunk Head
ARM	ST1524		Rivet-Blind, 0.125 Countersunk Head
ATL	ST1212	AMS 4730	Rivet-Blind, 0.125 Countersunk Head
ATL	ST1213	AMS 4730	Rivet-Blind, 0.156 Countersunk Head
ATL	ST1214	AMS 4730	Rivet-Blind, 0.188 Countersunk Head
AZC	ST2491	AMS 5687	Rivet-Blind, Countersunk Head, 0.140, 0.173, 0.201, 0.267 Diameter
MAV	NA0015-( ) N	2117-T4	Rivet-100 dia. Countersunk Head (Metric)
XL	AN123451 thru AN123600	AMS 7229	Rivet-Countersunk Head
XM	AN123601 thru AN123750	AMS 7232	Rivet-Countersunk Head
XN	AN124951 thru AN125100	AMS 7228	Rivet-Countersunk Head
XO	AS125101 thru AS125250	AMS 7225	Rivet-Countersunk Head, Cad. Plated
XP	AS125251 thru AS125400	AMS 7222	Rivet-Countersunk Head
XR	(Now WT. Refer to Table 202)		
XT	ST2226	AMS 4676	Rivet-0.125 Countersunk Head
XT	ST2227	AMS 4676	Rivet-0.156 Countersunk Head
XT	ST2228	AMS 4676	Rivet-0.188 Countersunk Head

BASIC CODES	PART NUMBERS	MATERIALS	DESCRIPTION
XU	ST2244	AMS 7236	Rivet-0.188 Countersunk Head
XV	ST2197	AMS 5737	Rivet-Blind, 0.156 Countersunk Head
XAC	ST1212	AMS 4730	Rivet-Blind, 0.125 Countersunk Head
XAC	ST1213	AMS 4730	Rivet-Blind, 0.156 Countersunk Head
XAC	ST1214	AMS 4730	Rivet-Blind, 0.188 Countersunk Head
XAC	(Now ARF. Refer to Table 202)		
XAL	ST2252	AMS 7237	Rivet-Countersunk Head
XAO	ST3228	AMS 7228	Rivet-Tubular, Countersunk Head
XAP	AS3230	AMS 7232	Rivet-Tubular, Countersunk Head

(2)Upper right quadrant (Ref. Fig. 201, 203)
(a)The rivet diameter and location of the manufactured head are shown by a number-letter code (for example 4N).
1 Number codes to a specific rivet diameter are listed in Table 205. The number represents the rivet diameter in 32nds of an inch.
2 The letter indicates the position of the manufactured head. "F" equals "Far Side" and "N" equals "Near Side". The side to which the arrow is directed is called the near side.
NOTE : No letter is included in the code when the location of the manufactured head is optional, or otherwise described in the assembly illustration.

Rivet Diameter
Table 205

CODES	RIVET DIAMETER
2	0.062 in.
3	0.094 in.
4	0.125 in.
5	0.156 in.

CODES	RIVET DIAMETER
6	0.188 in.
8	0.250 in.
10	0.312 in.
12	0.375 in.

(3)Lower left quadrant (Ref. Fig. 201, 204)
(a)The sheets to be countersunk are shown in the lower left quadrant by a number-letter code as follows :
1 Unless specified differently in this quadrant, the nominal angle of the countersink must be the same as the angle of the manufactured head.
2 Code C is used for Machine Countersink.
3 Code D is used for Form-Dimple.
4 Code DC is used for Form-Dimple Plus Machine Countersink.
5 Code K is used for Coin-Dimple.
6 Rivets that are flush on each side are shown with the letter-number code on two different lines. The first line shows the countersink operation for the manufactured head. The second line shows the countersink operation for the upset head. If the angle is different from the manufactured head, the included angle will be shown without the degree symbol.
7 The word FLUSH is included in this quadrant where the close flushness applies.
8 Special preparation instructions will be necessary for any other code designation in this quadrant.

(4)Lower right quadrant (Ref. Fig. 201, 205)
(a)The recommended length of the rivet is specified in this quadrant when a letter code is shown in the upper left quadrant. When a length is specified, it is for reference only.

4. General

A. Hole Size
(1)The rivet hole must have dimensions shown in Table 206 as applicable, except as specified in Special Rivet and Pin Types.

B. Hole Preparation
(1)Unless otherwise specified in the next steps, rivet holes must be made at assembly, although the use of rigging holes is permitted. Rigging holes are holes produced at the detail level with the use of various types of fixtures. These holes, held in their relative position by the fixtures, are then used to locate the position of rivet holes at the

MC	4N
C	.375 (9.525)

TYPICAL RIVET SYMBOL

UPPER LEFT QUADRANT:
Identity of rivet (shown by part number or letter code)

UPPER RIGHT QUADRANT:
Rivet diameter and manufactured head location (Number = rivet diameter in 32nds. Location of manufactured head:
"F" = far side
"N" = near side
If no letter is shown, head location is optional)

LOWER LEFT QUADRANT:
Countersunk specification
(A dash in the upper line shows that countersunk is not necessary on the manufactured head.
Letter "C" is an indication of machine countersinking preparations.
Special instructions will be necessary for any other code.)

LOWER RIGHT QUADRANT:
Reference length of rivet.
(Applies only when letter code is shown in upper left quadrant.)

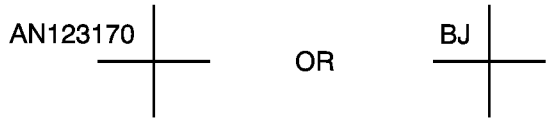
CROSS SYMBOL

RIVET SYMBOL QUADRANT

BM5 70 22 16 2 KAM0 00

G-12610 (0807)
PW V

Rivet Symbols
Figure 201



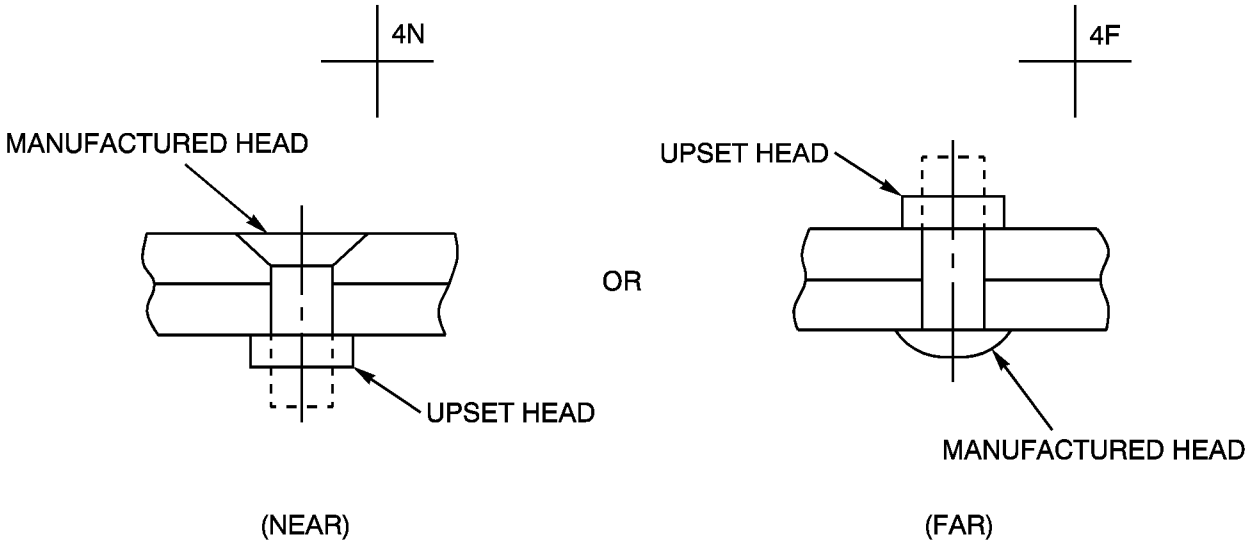
(PART NUMBER) (LETTER CODE)

UPPER LEFT QUADRANT
(TYPICAL)

BM5 70 22 16 2 KBM0 00

G-12611 (0807)
PW V

Upper Left Quadrant Definition
Figure 202

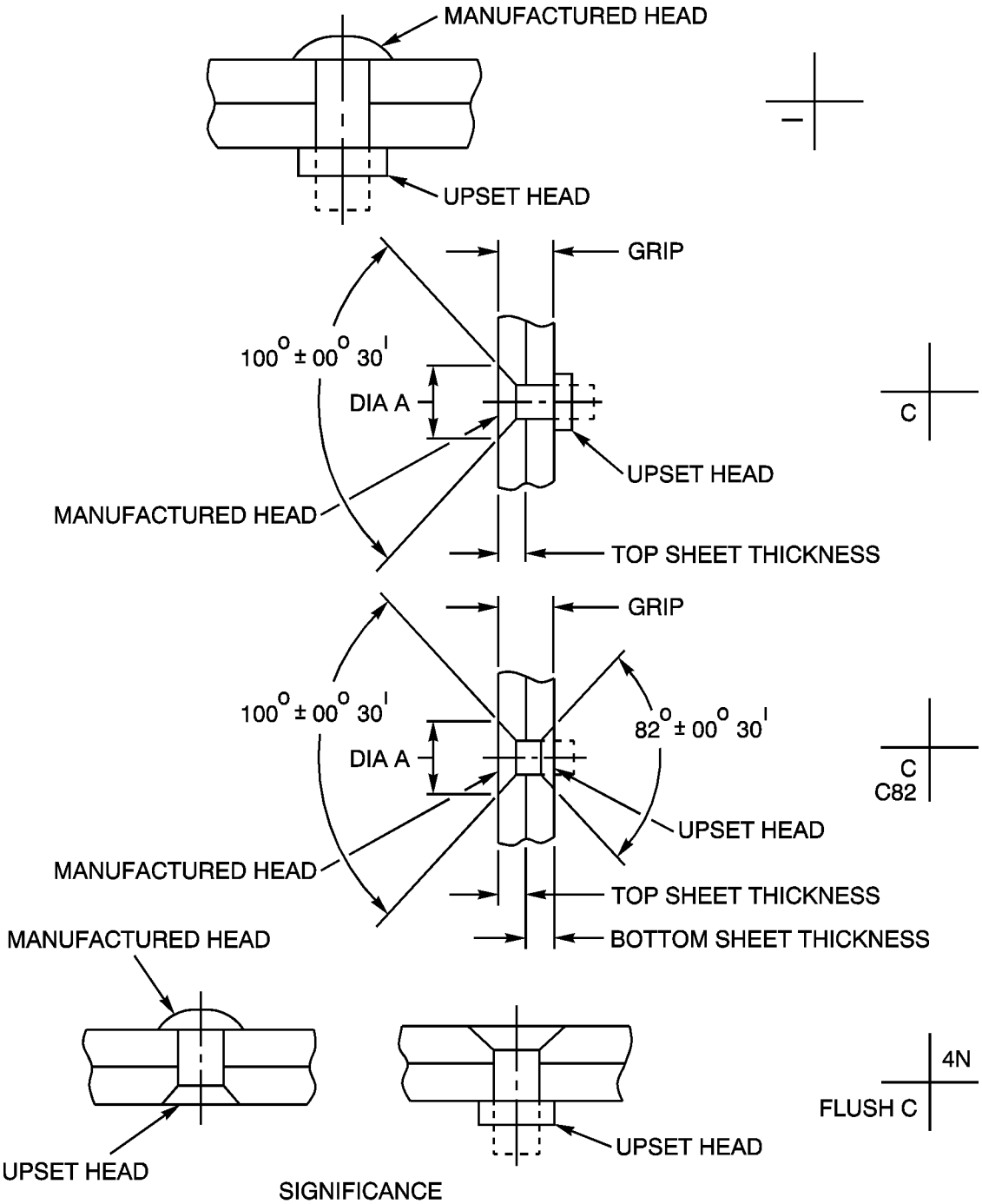


UPPER RIGHT QUADRANT
(TYPICAL)

BM5 70 22 16 2 KCM0 00

G-12612 (0807)
PW V

Upper Right Quadrant Definition
Figure 203

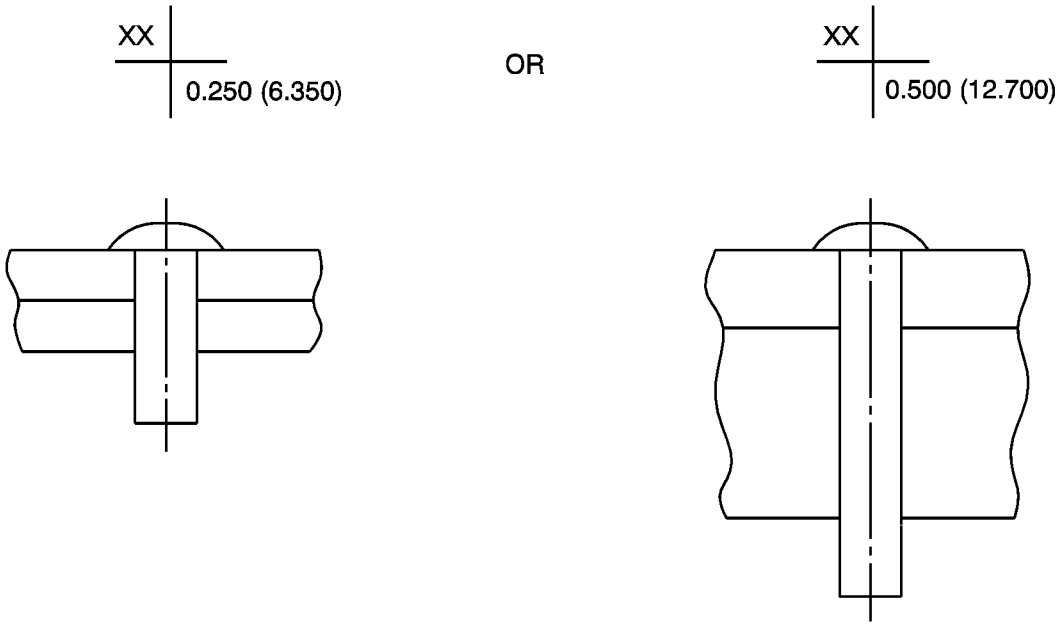


SIGNIFICANCE
MANUFACTURED OR UPSET HEAD SHAVED
.0000 – .0005 INCH (.000 – .013 mm) ABOVE SHEET AS SHOWN

G-12613 (0807)
PW V

BM5 70 22 16 2 KDM0 00

Lower Left Quadrant Definition
Figure 204



LOWER RIGHT QUADRANT
(TYPICAL)

BM5 70 22 16 2 KEM0 00

G–12614 (0807)
PW V

Lower Right Quadrant Definition
Figure 205

assembly level. Chips between sheets that could cause sheet separation must be removed before riveting. Where it can be established, the riveting process (that is, manual or automatic) will provide clamping that will not permit chips or burrs to be expelled between sheets, it will not be necessary to separate the sheets for cleaning. Perpendicularity must not be more than dia. 5 for diameters up to 0.250 in. (6.350 mm) and dia. 3 for diameters 0.250 in. (6.350 mm) and over.

(2)Holes in detail

(a)Rivet holes for fixed or floating anchor nuts, gang channel nut assemblies, and any other fasteners that use rivets for or at assembly retention only, can have the holes drilled in detail or at assembly.

(3)Hole alignment

(a)Riveted elements can be separated after drilling and before riveting, if the elements are indexed so that the elements and hole alignment will be the same at riveting as when drilled.

(4)Rotating or revolving parts

(a)Holes must be smooth, free from burrs that could prevent seating of the rivet or cause sheet separation, with a 0.005 in. (0.127 mm) maximum broken edge, and normal to the penetrated surfaces.

(5)Static parts

(a)A burr collar is acceptable if permitted in Quality Requirements - Upset Heads (See paragraph 6.).

(b)Any rivets that are loose after setting must be replaced.

(c)If deburring is necessary, edges can be broken 0.005 in. (0.127 mm) maximum.

(6)Hole quality

(a)Holes must be free of any cracks.

(7)Peening

(a)Usually, where the upset head of a solid rivet is formed by a riveting gun (repetitive blows), the bucking bar (anvil) must be held against the pin end of the rivet and the repetitive blows applied to the manufactured head (conventional riveting).

(b)Where part configuration prevents upsetting the rivet in the normal manner, the bucking bar can be held against the manufactured head and the repetitive blows applied to the pin end of the rivet (reverse riveting) if all other applicable requirements of PWA 357 are met.

(8)Hand peening

(a)Hand peening of the shank to upset the head of rivets made of materials in Table 207 is not permitted because of the rapid cold working of the material that results in the shank not swelling to fill the hole.

(b)Hand peening uses a hammer to deform the rivet head by hand (manually).

NOTE : The use of hand-held pneumatic tools is not considered a form of hand peening.

C. Counter Surfaces for Flush Rivets

(1)Surfaces

(a)Counter surfaces for rivets must be such that a good match is made with the manufactured rivet head and that the manufactured head is flush to high before driving.

(2)Flushness of flush head rivets

(a)The manufactured rivet head must be 0.000 to 0.005 in. (0.000 to 0.127 mm) high after driving. The manufactured heads of driven rivets that are 0.005 to 0.010 in. (0.127 to 0.254 mm) high must be shaved to 0.000 to 0.005 in. (0.0000 to 0.127 mm) high (Ref. Fig. 208).

(b)The upset rivet head (that is set into a countersunk or chamfered hole), must be flush to 0.020 in. (0.508 mm) above the surface (Ref. Fig. 207).

(c)Rivet head shaving

1 Rivets that are plated (cadmium, etc.) for corrosion protection must not be shaved to get the necessary flushness.

2 Inspection will usually be done before shaving, but limits of (Ref. Fig. 208) or (Ref. Fig. 209) must be used as a guide to determine if excessive material has been shaved from the rivet head.

3 Where the assembly illustration specifies "FLUSH", manufactured (or upset) heads must be shaved to 0.000 to 0.0005 in. (0.000 to 0.0127 mm) high (Ref. Fig. 207).

4 If flushness is produced by grinding, no burns are permitted.

5 Also see the next step for anchor nut rivets.

(d)Flushness for anchor nut rivets

1 Where the assembly illustration specifies "FLUSH", the manufactured head of rivets used to retain anchor (or plate) nuts can be set 0.000 to -0.005 in. (0.000 to -0.127 mm) below the sheet surface or shaved to get the necessary flushness.

(3)Table 206 and (Ref. Fig. 206) list the necessary hole and recommended counter surface dimensions. Counter surface dimensions can be varied somewhat to get the correct flushness of the finished rivet.

(4)Unless specified differently, counter surfaces must be smooth, free from burrs, cracks, or chatter marks and concentric with the rivet hole whithin 0.005 in. (0.127 mm) FIR.

(5)Counter surface types

(a)Machine countersink for manufactured head

1 When the counter surface is produced by machine countersinking (Symbol "C"), the finished hole size must be as given in Table 206. The counter surfaces must be as shown in (Ref. Fig. 206) (View A). The countersink must not extend through the top sheet.

2 In plastic sheet, the nominal angle of the counter surface can be reduced three degrees from the nominal angle of the manufactured head of the rivet.

(b)Machine countersink for upset end

1 When it is required to upset the end of the rivet into the machine countersink, the finished hole size must be as given in Table 206 and the counter surface must be as shown in (Ref. Fig. 206) (View B).

D. Protruding Head Rivets

(1)Hole size

(a)The hole size for protruding head rivets must be as given in Table 206.

(2)Direction of assembly

(a)The direction of assembly is optional unless given as not optional on the assembly illustration or in the assembly instructions. In general, the upset head must be on the side of the thicker sheet or harder material.

(b)A dash will be used for the upper line in the lower left quadrant, as there is no countersink necessary with this head style (Ref. Fig. 210).

E. Rivet Location, Spacing, And Edge Distance

(1)Nominal rivet spacing and edge distance must be as shown on the assembly illustration. Rivet holes must be located within a true position radius of 0.030 in. (0.762 mm) and/or 0.060 in. (1.524 mm) in run. Mistmatch between corresponding holes must not be more than 0.001 in. (0.025 mm).

(2)For minimum inspection spacing and edge distance for riveted assemblies see Table 209. These limits must be followed unless permitted in Quality Requirements - Replacement Rivets (See paragraph 6.).

(3)When the length of an equally spaced rivet run is fixed by dimensions to end holes, the actual part length will vary from assembly to assembly. In such cases, it may be desirable to vary the spacings toward the end of the run in order that most of the holes may be located with templates or drill jigs. Spacing may be increased or decreased by 0.060 in. (1.524 mm) maximum for as many spaces as necessary to blend end holes into an even pattern if the minimum dimensions in Table 209 are followed.

F. Faying Surfaces

(1)Nominal faying surfaces

(a)Unless otherwise specified, the maximum clearance between all faying surfaces in a riveted assembly (where a gap is not specifically permitted) within a diameter equal to twice the manufactured head diameter, must be 0.001 in. (0.025 mm). For sheet metal components, the maximum gap of 0.001 in. (0.025 mm) must apply within one manufactured head diameter. The maximum gap (sheet separation) between rivets, but beyond the distance given above, must be as follows (Ref. Fig. 211) (View A).

1 For rivet spans up to and including 23 times the nominal thickness of the thinnest sheet, the maximum gap is 0.010 in. (0.254 mm).

2 For rivet spans 24 or more times the nominal thickness of the thinnest sheet, maximum gap is 0.020 in. (0.508 mm).

(2)Parts with anchor nut plates riveted to convex surfaces

(a)Within a diameter equal to twice that of the manufactured rivet head, a maximum gap (sheet separation) of 0.010 in. (0.254 mm) is acceptable if there is line contact between the sheet surface and the rivet head for the full head diameter in at least one plane that contains the rivet axis. (Ref. Fig. 211) (View B).

(b)Beyond this point, the gap must decrease to a point of no clearance halfway between rivets.

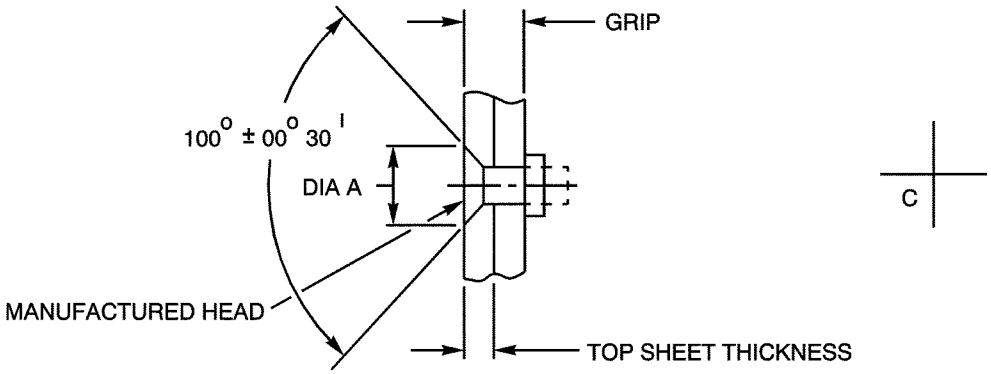
(3)Parts with anchor nut plates riveted to concave surfaces
(a)Within a diameter equal to twice that of the manufactured rivet head, a maximum gap (sheet separation) of 0.003 in. (0.076 mm) is acceptable if there is line contact between the sheet surface and the rivet head for the full head diameter in at least one plane that contains the rivet axis. (Ref. Fig. 211) (View C).
(b)Maximum acceptable clearance at a point halfway between rivets must be 0.010 in. (0.254 mm).
(4)Parts with plastic details (including reinforced plastic)
(a)Within a diameter equal to twice that of the manufactured rivet head, a maximum gap of 0.005 in. (0.127 mm) is acceptable if there is a line contact between the sheet surface and the rivet head for the full head diameter in at least one plane that contains the rivet axis. If the manufactured rivet head contacts a convex plastic sheet, a minimum of two points of contact between the head and the sheet must be maintained.

G. Rivet Length
(1)When the rivet length is specified in the rivet symbol, the length is for reference only and may be varied at assembly as necessary. The limits in Quality Requirements (see paragraph 6.) must be maintained. Rivets made of titanium base alloys must not be trimmed to get the necessary length.

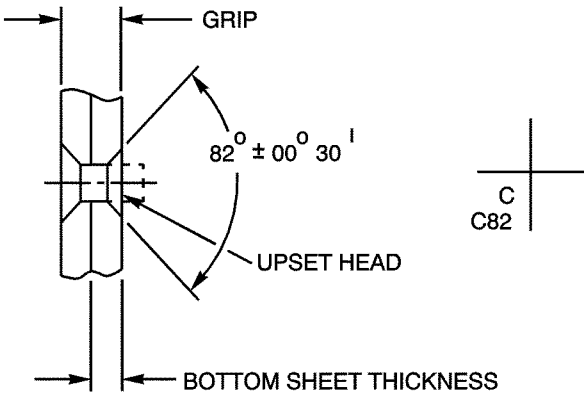
H. Bend-to-Rivet Distance
(1)The manufactured head of the rivet must not extend onto the radius of the bend (Ref. Fig. 212).
(2)The upset head may extend onto the radius of the bend by the amount "B" listed in Tables 207 and 208, (Ref. Fig. 212).
(3)The minimum distance from the bend radius to the axis rivet hole, distance "C" in (Ref. Fig. 212), must not be less than 0.5 times the rivet hole diameter.

5. Special Rivet and Pin Types

A. Blind Rivets
(1)For General Requirements For Blind Rivets, refer to Quality Requirements (see paragraph 6.).
(2)Hole requirements for such rivets must be as given in the assembly instructions. Counter surface requirements, as needed, must be as given in Table 206.
(3)Blind rivets must be used in the "as received" condition. These rivets are lubricated by the manufacturer and heat, degreasing, or solvent washing will destroy the effectiveness of the lubricant and will make the rivets unsatisfactory for use.
(4)Dented, nicked, dirty, mixed, relubricated, reclaimed, or damaged blind rivets must not be used.
(5)The free substitution of one type of blind rivet for another is not permitted. The selection of longer or shorter grip range rivets to meet grip length requirements is not permitted unless specified in assembly instructions.



VIEW A
(FOR MANUFACTURED HEAD)



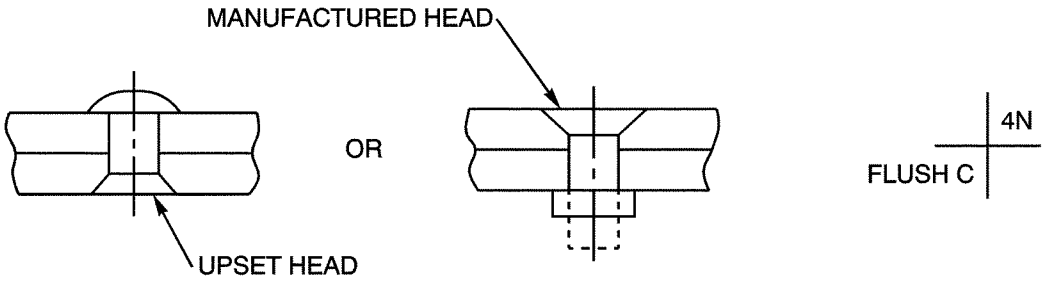
VIEW B
(FOR UPSET HEAD)

G–12615 (0807)
PW V

BM5 70 22 16 2 KFM0 00

NOTE: REFER TO TABLE 206

Machined Countersink for Rivet Manufactured
Head and Upset Head
Figure 206

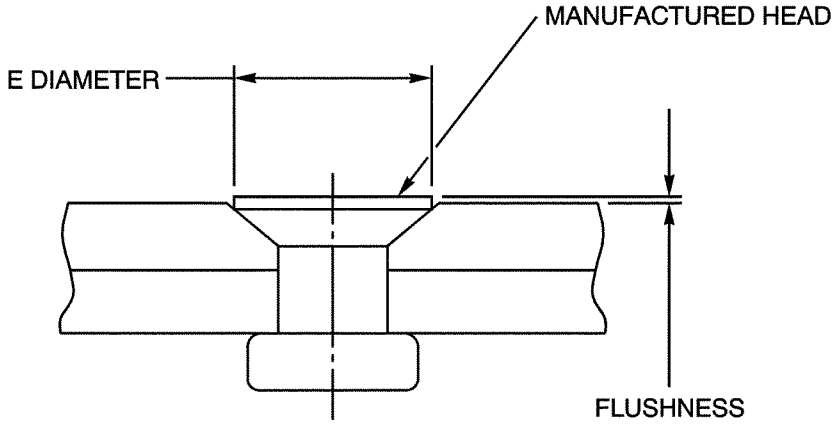


G-12616 (0807)
PW V

BM5 70 22 16 2 KGM0 00

MANUFACTURED OR UPSET HEAD SHAVED TO 0.0000 - 0.0005 OF THE SHEET AS SHOWN

Shaved Manufactured or Upset Heads
(Limits in Inch)
Figure 207

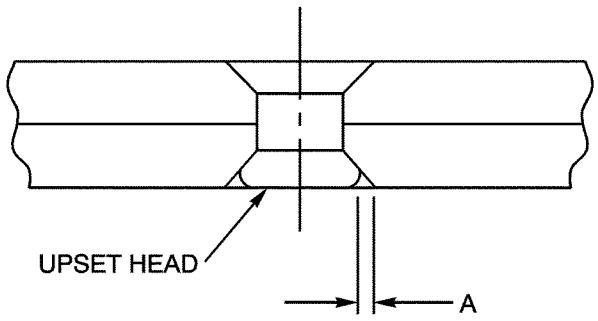


G-12617 (0807)
PW V

NOMINAL RIVET DIAMETER (INCH)	E DIAMETER MINIMUM (INCH)
0.062	0.098
0.094	0.163
0.125	0.206
0.156	0.265
0.188	0.330
0.250	0.453
0.312	0.541
0.375	0.671

BM5 70 22 16 2 KHM0 00

Minimum Head Diameter When Manufactured
Rivet Head is Shaved
Figure 208

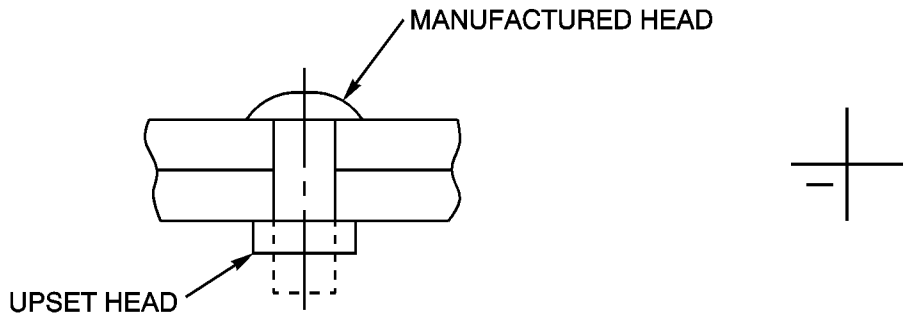


G–12618 (0807)
PW V

BM5 70 22 16 2 KJM0 00

NOMINAL RIVET DIA. (INCH)	MAX. GAP A (INCH)	NOMINAL RIVET DIA. (INCH)	MAX. GAP A (INCH)
0.062	0.008	0.188	0.024
0.094	0.012	0.250	0.032
0.125	0.016	0.312	0.040
0.156	0.020	0.375	0.048

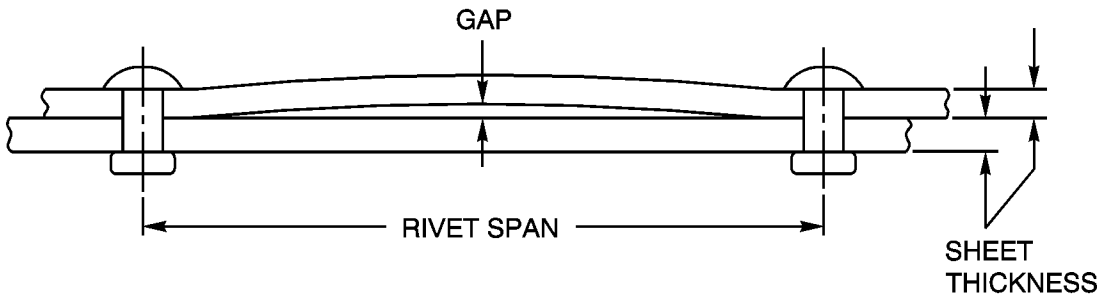
Maximum Gap Allowable Between Edge of
Upset Rivet Head and Sheet
Figure 209



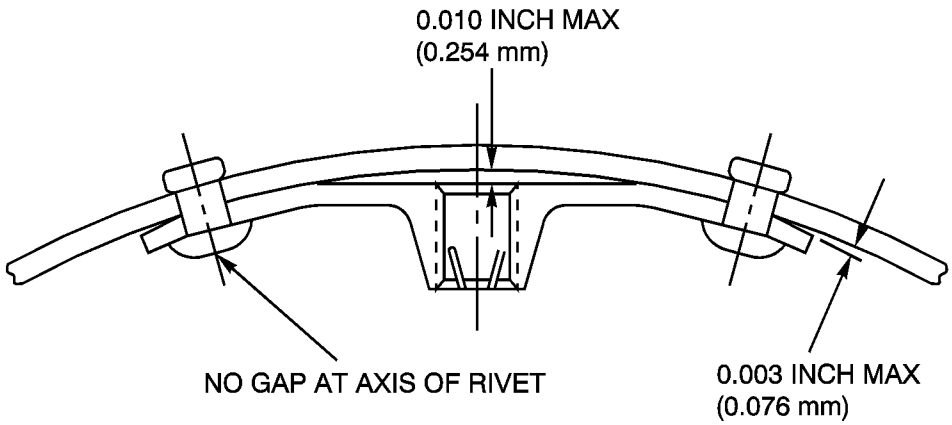
BM5 70 22 16 2 KKM0 00

G-12619 (0807)
PW V

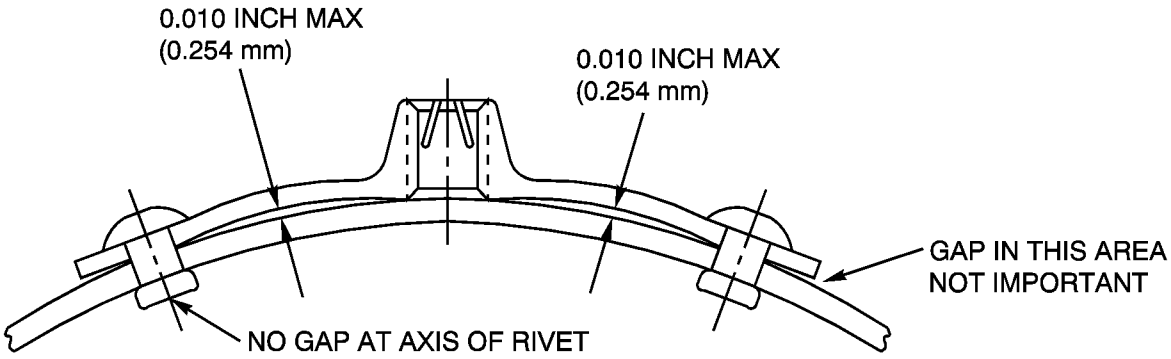
Protruding Head Rivet
Figure 210



VIEW A
NOMINAL FAYING–SURFACE GAP



VIEW B
ANCHOR NUTPLATES TO CONCAVE SURFACE

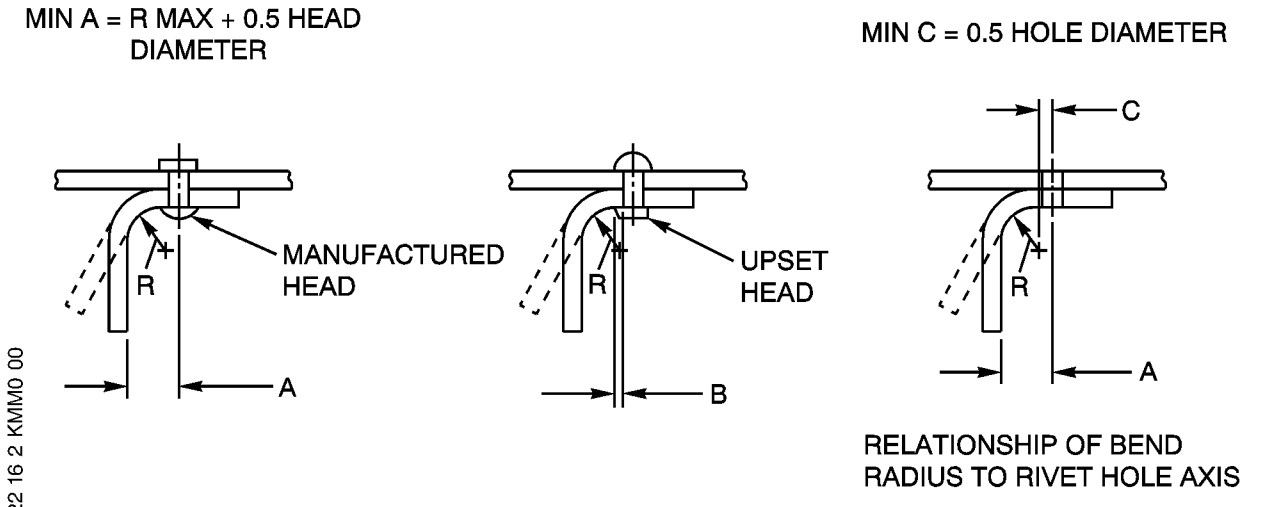


VIEW C
ANCHOR NUTPLATES TO CONVEX SURFACE

G–12620 (0807)
PW V

BM5 70 22 16 2 KLM0 00

Nominal Faying and Anchor Nut Clearance
Figure 211



Bend to Rivet Distance (Inch)
Figure 212

(6)Flush blind rivets and bolts, and rivet pins
(a)The manufactured head of blind rivets, blind bolts, and rivet pins must be -0.005 to +0.010 in. high after driving. The manufactured head must not be deformed to get the corrected flushness. Where the assembly illustration specifies "FLUSH", the manufactured head must be shaved to +0.0005 in. (0.013 mm) high. Use (Ref. Fig. 208) as a guide to determine if too much material has been shaved from the rivet head. Refer to General Requirements For blind Rivets, Quality Requirements, (see paragraph 6.) for exceptions to the above.

B. Rivet Pins
(1)Hole and counter surface requirements for rivet pins must be as given in assembly instructions.
(2)Free substitution of varying types of rivet pins is not permitted.

C. Hi-Shear Stumps Pins and Collars
(1)Refer to Quality Requirements, General Requirements For Hi-Shear Stump pins And Collars (see paragraph 6.).

D. Huck Tension Stump and Tension Pull Rivet Pins and Collars
(1)Refer to Quality Requirements, General Requirements For Huck Tension Stump And Tension Pull Rivet Pins and Collars (see paragraph 6.).

E. Corrosion Protection
(1)Where the assembly illustration requires that the broken ends of blind rivets and rivet pins are to receive a protective treatment obey the treatment instructions in the repair procedure. Apply the applicable treatment as soon as possible after installation of the rivet or pin.

6. Quality Requirements

A. Holes and Counter Surfaces
(1)Holes must be free of any cracks.
(2)Counter surfaces must be smooth, free from burrs, cracks, or chatter marks, and concentric with rivet hole within 0.005 in.(0.127 mm) FIR.

B. Upset Heads (Solid Rivets)
(1)General
(a)The upset head must have the necessary dimensions given in (Ref. Fig. 213) (View A) and Tables 207 and 208.
(b)For rivets made of materials not listed in Tables 207 and 208, use the values shown in Table 207.
(2)Concentricity
(a)The upset head of the rivet may be eccentric to the shank if the shank cannot be seen.
(3)Malformed upset heads
(a)The upset head may be malformed as shown in (Ref. Fig. 213) (View B) if, for any one rivet, the measured difference between maximum and minimum head height does not exceed the values given in Tables 207

and 208. Any head that is malformed, other than permitted in these specifications, is not acceptable.

(4)Stepped heads

(a)The upset head may be stepped due to an offset driver or bucking bar if the stepped portion is not less than the minimum head thickness and the raised portion is not more than the maximum head thickness given in (Ref. Fig. 213) (View C) and Tables 207 and 208.

(5)Flattened manufactured head

(a)The manufactured head of protruding head rivets may be flattened by use of a flat driver or bucking bar if the head is not thinned below the minimum head height values given for upset heads in (Ref. Fig. 213) (View B) and Table 208, regardless of the material.

(b)Rivets that have manufactured head heights less than these values before driving must not be flattened.

(6)Open heads on Flush and protruding head rivets

(a)If necessary, locally fabricate a Rivet Gap Inspection Shim. (Ref. Fig. 214) for details.

(b)Solid rivets

1 Gaps between the upset head or manufactured head of installed solid shank rivets and the surface of that part being riveted must be evaluated as follows.

2 There must be no measurable gap under the upset head of an installed solid shank rivet (Ref. Fig. 214).

3 The manufactured head of all protruding head rivets must seat such that the 0.002 in. (0.051 mm) Gap Shim does not touch the rivet shank when examined (Ref. Fig. 215) (View A).
Contact with the rivet shank is found when the shim does not wedge and will move freely under the head as shown in (View B).

4 The manufactured head of all flush head rivets must seat such that :
- The 0.002 in. (0.051 mm) Gap Shim cannot be inserted between the rivet head and the countersink for more than dia. 145 of circumference of the head (Ref. Fig. 216).
- The 0.002 in. (0.051 mm) Gap Shim does not touch the rivet shank (Ref. Fig. 216) (View B).

5 Rivets with gaps 0.002 in. (0.051 mm) or less under the upset head must be struck again.

6 Rivets with gaps larger than 0.002 in. (0.051 mm) must be replaced.

7 Rivets with gaps between the manufactured head and the sheet in excess of the amount permitted in the previous steps, must be replaced.

8 At least 50 % of the manufactured head must have zero gap with the sheet.

(c)Blind and hollow rivets, bolts and rivet pins

1 Flat surfaces
- For protruding head rivets, bolts, and pins, a 0.005 in. (0.127 mm) maximum gap is permitted between the manufactured head and the flat sheet surface, if at least 40 % of the head circumference touches the sheet surface (Ref. Fig. 217) (View C).

- For countersunk manufactured heads, a 0.003 in. (0.076 mm) maximum gap is permitted between the rivet head and the countersink, if no gap appears for at least 50 % of the rivet head circumference (Ref. Fig. 217) (View C).

2 Curved surfaces

- Protruding head rivets, bolts, and pins set to curved surfaces may have gaps around the head circumference if there is line contact between the sheet surface and the rivet head for the full head diameter in at least one plane that contains the rivet axis.

(d)Plastic sheets

1 The requirements of the previous step (Blind And Hollow Rivets, Bolts And Rivet Pins), apply for solid rivets in assemblies that contain plastic or reinforced plastic sheets.

(e)Rivets used to attach anchor nuts and gang channel nuts

1 Rivets used to attach anchor nuts and gang channel nuts must be tight after they are installed.

2 The gap control is not necessary.

3 For all instructions which must be obeyed, refer to General - Parts With Anchor Nut Plates Riveted To Convex Surfaces and Parts With Anchor Nut Plates Riveted To Concave Surfaces (see paragraph 4.).

(7)Flush heads

(a)Flush head rivets that seat below the surface of the sheet before or after driving are not acceptable.

(b)Rivets that are plated for corrosion protection must not be shaved to get the necessary flushness.

(8)Cracks

CAUTION : RIVETS MADE OF CERTAIN MATERIALS (SUCH AS, AMS 7223) MAY REQUIRE STORAGE AT LOW TEMPERATURE UNTIL USED TO PREVENT PREMATURE PRECIPITATION HARDENING WHICH MAY CAUSE CRACKS IN UPSET HEADS.

(a)Manufactured heads

1 No cracks are permitted in the manufactured head of the rivet.

(b)Upset heads

1 Limited cracks are permitted in the upset head if they do not exceed the limits shown (Ref. Fig. 218).

2 Cracks are not permitted in more than 10 % of the rivets in a pattern.

3 Cracks are not permitted in AMS 7223 material rivets.

4 Rivets having cracks in the periphery of the upset head running approximately in a radial direction are acceptable if they do not extend within Diameter A and do not exceed Length B. See (View B).

5 The width of any crack must not exceed 0.062 times the shank diameter. See (View A).

6 Cracks in any location of the upset head other than shown in (View B) are not acceptable.

7 Rivets having cracks in the periphery of the upset head resembling a wedge, such that a chip may fall out, are not acceptable. (See View C).

8 Cracks in the swaged or flared end of hollow rivets are not acceptable.

(9)Manufactured head damage

(a)Protruding head rivets
1 Protruding head rivets that have the manufactured head ringed by the rivet set are acceptable if not more than 10 % of the rivets in the pattern are ringed, and the depth of the cut is not more than 25 % of the driven head height (Ref. Fig. 219).
2 Any rivet having the head ring offset more than 0.125 times the head diameter is not acceptable.
(b)Flush head rivets
1 The manufactured head may be indented by the rivet set (mandrel) if the rivet set is equal to or slightly smaller than the rivet head diameter and has a spherical radius of not less than 1.000 in. (25.400 mm).

C. Hollow rivets
(1)Sheet hole size
(a)The sheet hole size for such rivets must be as given in Table 206.
(b)Cracks in the swaged or flared end are not acceptable.
(c)The rivet end must be swaged to a minimum diameter that is equal to the shank diameter plus 15 % of the shank diameter.
(2)Flare angle
(a)Set into a chamfered rivet hole (Ref. Fig. 220) (View A).
1 To prevent excessive thinning of the flare bend, the angle of the flare must be approximately the same as the chamfer into which the flare is set.
2 The maximum chamfer angle must be the minimum angle of the approved setting tool.
(b)Set into a non-chamfered rivet hole (Ref. Fig. 220) (View B).
1 The flare angle must be approximately 60 degrees.

D. Sheet Discrepancies
(1)Deformation of the sheet (such as, bulging of sheet edges), or open seams that permit a 0.001 in. feeler to reach the rivet shanks, or other undesirable sheet displacement, is unacceptable (Ref. Fig. 221).
(2)Sheet bulging caused by the expansion of rivet shanks between sheets is unacceptable. See (View A).
(3)Sheet bulging caused by the entrapment of chips between sheets is unacceptable. See (View B).
(4)Sheet damage by rivet set or shavers.
(a)Cuts or sharp tool marks around the rivet head due to excessive pressure of the rivet gun or tooling are not acceptable.
(b)A smooth mark that does not reduce the sheet thickness below its minimum tolerance limit is acceptable.
(5)Counter surfaces
(a)Eccentric or oversize machine countersinks are not acceptable. Cracks in any counter surface are not acceptable.
(6)A minimum gap of 0.002 in. (0.051 mm) must be maintained between adjacent sheets before sheets are riveted (Ref. Fig. 222).

E. Loose Rivets and Blind Rivet Stems
(1)Rivets that are loose after setting must be replaced.
(2)Blind rivet with stems that are loose are not acceptable and must be

replaced. See Table 210 for the typical load that is necessary to push out the installed and locked stem.

(a)The installed and locked stem must meet or exceed the push-out limits given in Table 210.

(b)The stem push-out tool must be 0.007 in. (0.178 mm) smaller than the minimum rivet stem.

F. Replacement Rivets

(1)Worn, damaged or incorrectly driven rivets can be removed and replaced if :

(a)Not more than 10 percent of the rivets in the pattern are affected.

(b)The rivets are used to join metal sheets only.

(c)The replacement rivet is installed per the same size replacement rivet steps or larger size replacement rivet steps in the subsequent steps :

1 Same size replacement rivet.

2 Larger size replacement rivet.

G. Same Size Replacement Rivet

(1)You can use a same size replacement rivet if the hole diameter does not exceed the limits shown in Table 206 by more than 0.002 in. (0.051 mm).

H. Larger Size Replacement Rivet

(1)You can use a replacement rivet that is one size larger in diameter when there are enlarged or differently damaged rivet holes and countersurfaces if :

(a)Damage does not exceed the tolerance for the next larger size rivet installation. See Table 206.

(b)Ninety percent of the minimum specified edge distance and spacing is remaining for the larger rivet.

(c)There is sufficient head clearance for the larger rivet.

(d)The sheet thickness is not less than the minimum limit, necessary for the larger rivet. See Table 206.

(e)Dimples are not restruck to permit the use of larger rivets.

(2)The use of larger size rivets is not limited to a specific number of holes on the part.

NOTE : When larger sized rivets are used, be careful to maintain the same applicable material thickness, head clearance, and edge distances.

I. Gap Between Edge Of Upset Rivet Head and Sheet

(1)The maximum gap A (in inch) allowable between edge of upset rivet head and sheets is shown in (Ref. Fig. 209).

J. General Requirements For Blind Rivets

(1)Stem and locking collar flushness

(a)For those rivets (other than CheryMAX) where the stem snaps off flush with the manufactured head of the rivet :

1 The stem and locking collar flushness must be within the limits given in (Ref. Fig. 223).

(b)For CherryMAX rivets :

1 The locking collar must be flush within ± 0.005 in. (0.127 mm) with the top surface of the rivet head.
2 Stem flushness must be within the limits shown in (Ref. Fig. 224).
3 Where the locking collar is flush with the top of the rivet head, it can be safely concluded that the stem is within flushness tolerance limits.

(c) All rivet stem dimensions (including CherryMAX) refer to the top edge of the land adjacent to the break notch. No dimensional reference is made to the uneven break surface (Ref. Fig. 223, 224).

(d) For either type of rivet, a slight collar "flash", caused by the pressures necessary to drive the collar, is acceptable within the limit shown (Ref. Fig. 223, 224).

(2) Stem trimming

(a) The stem may be milled or trimmed flush with the head in all cases where the head will be exposed or where injury to personnel or damage to materials might result from untrimmed stems.

(b) The manufactured head of blind rivets, blind bolts, and rivet pins must be -0.005 to +0.010 in. high after driving. The manufactured head must not be deformed to get the correct flushness. Where the assembly illustration specifies "FLUSH", the manufactured head must be shaved to +0.0005 in. (0.013 mm) high. Use (Ref. Fig. 208) as a guide to determine if too much material has been shaved from the rivet head.

(c) Rivets that use locking collars to retain the stem must not have the heads or collars trimmed or shaved.

(d) Blind rivets with stems that are loose or do not meet the required axial push-out load given in Table 210 are cause for rejection and will require that the rivet be replaced. The installed and locked stem must meet or exceed the push-out limit given in Table 210. The stem push-out tool must be 0.007 in. (0.178 mm) smaller than the minimum rivet stem.

K. General Requirements For Hi-Shear Stump Pins And Collars

(1) Gaps

(a) No gaps are permitted betwen the surfaces which follow (Ref. Fig. 225) (View A).

1 The collar and pin.
2 The collar and sheet.
3 The manufactured head of the pin and the sheet in excess of limits given in Quality Requirements - Upset Heads, Blind And Hollow Rivets, Bolts And Rivet Pins (see paragraph 6.).

(2) Trim material

(a) Where the trim material has been sheared off the collar at the edge of the pin, a thin sharp fin not over 0.010 in. (0.254 mm) thick is acceptable (Ref. Fig. 225) (View B).

(b) The trim edge of the collar may be slightly ragged due to the trimming.

(3) Shoulder and/or ring

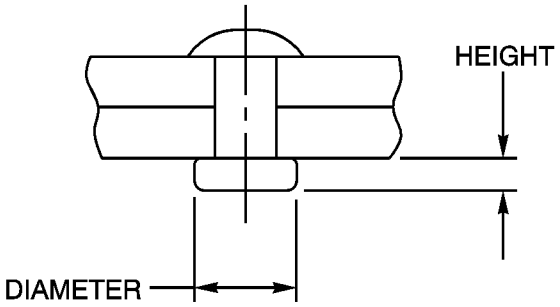
(a) The collar must be formed into a smooth cone which blends into the curved end of the pin.

(b) A shoulder may be formed at the base of the collar, or a ring up to 0.030 in. (0.762 mm) high may be formed at the top of the collar,

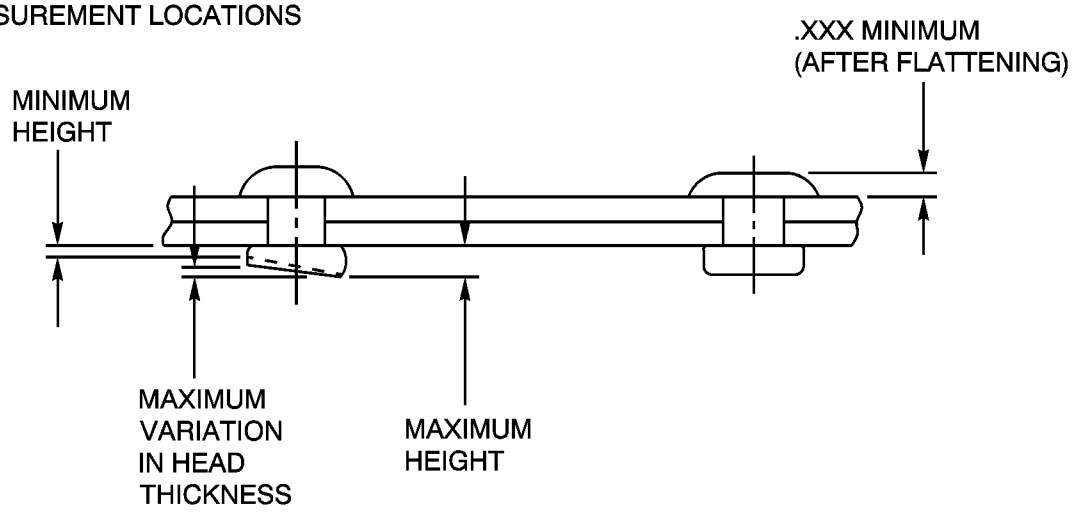
if all other requirements are met (Ref. Fig. 225) (View C).

L. General Requirements For Huck Tension Stump And Tension Pull Rivet Pins And Collars.
(1)Gaps
(a)No gap is permitted between the surfaces which follow (Ref. Fig. 226, 227)
1 The collar and sheet.
2 The manufactured head of the pin and the sheet in excess of limits given in Quality Requirements - Upset Heads, Blind and Hollow Rivets, Bolts And Rivet Pins (see paragraph 6.).
(2)Swaged collar dimensions
(a)The swaged collar must meet the dimensional requirements given in (Ref. Fig. 226, 227)
(3)Rivet pin projection
(a)The installed stump rivet pin must meet the projection requirements given in (Ref. Fig. 226) and the pull rivet pin must meet the projection requirements given in (Ref. Fig. 227) before trimming the break-off end.
(4)Rivet pin trimming
(a)The broken end of the rivet pin may be milled or trimmed to provide a smooth end. The swaged collar must not be touched by the trimming tool.
(5)Angled surface
(a)When the collar is swaged to an inclined or angled surface, Dimensions B and C in (Ref. Fig. 226, 227) must be inspected 90 degrees to the inclined surface.

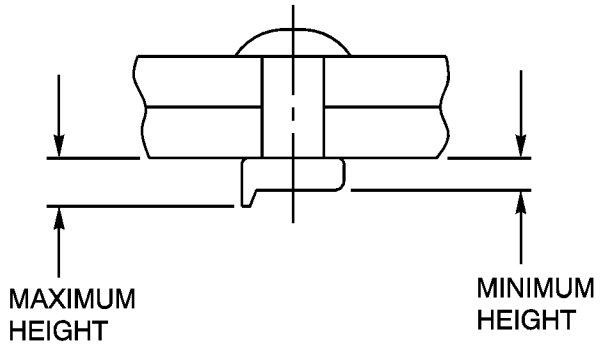
M. Impacted Burr Collars on Static Parts
(1)Impacted burr collars are permitted on parts used in static applications if:
(a)The requirements of Quality Requirements - Upset Heads, Blind and Hollow Rivets, Bolts and Rivet Pins are met (see paragraph 6.).
(b)The requirements of Quality Requirements - Faying Surfaces are met (see paragraph 6.).
(c)They do not extend more than 0.010 in. (0.254 mm) beyond the outside diameter of the upset head.
(d)They are tight and not able to be moved with finger pressure.



VIEW A
HEAD MEASUREMENT LOCATIONS



VIEW B
MALFORMED AND FLATTENED
RIVET HEADS

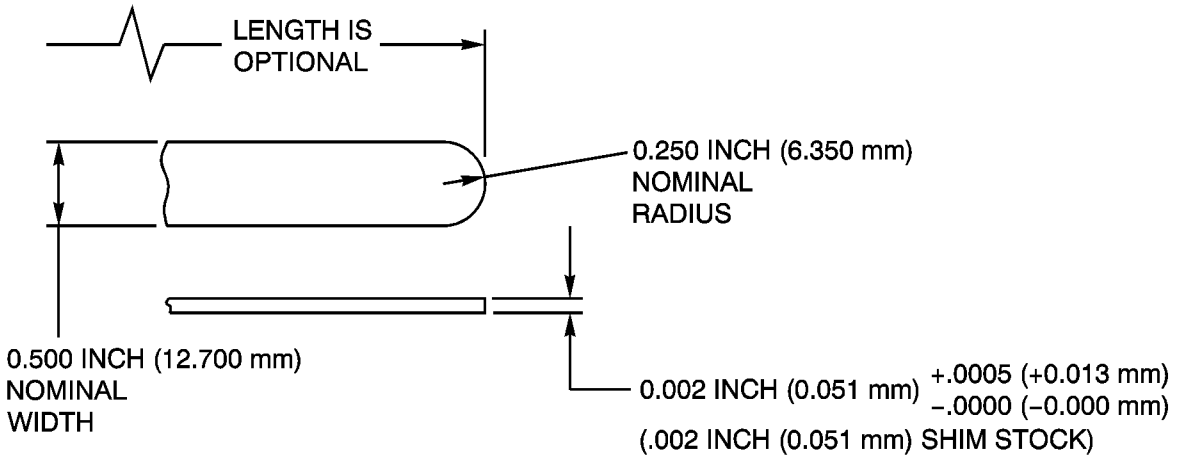


VIEW C
STEPPED RIVET HEAD

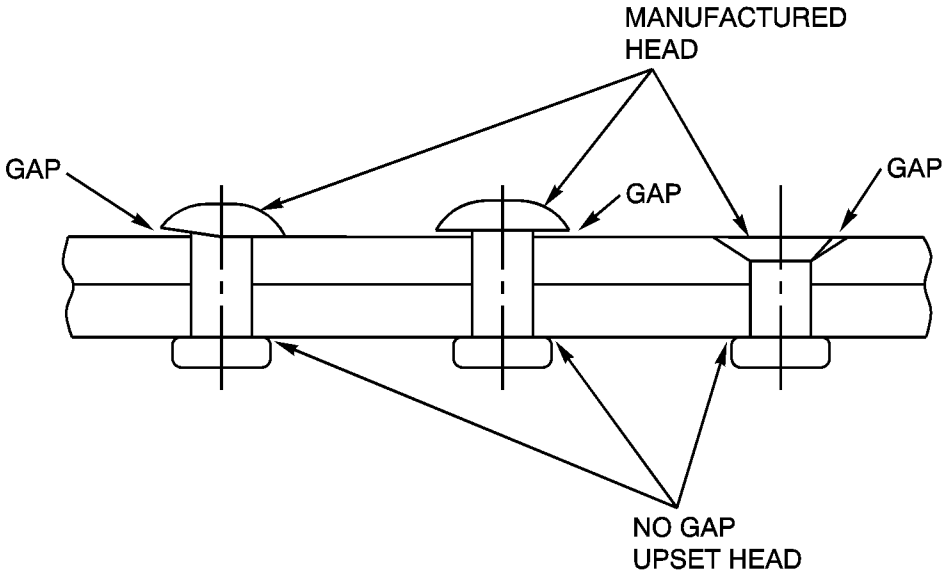
BM5 70 22 16 2 KNM0 00

G-12622 (0807)
PW V

Rivet Upset Heads
Figure 213



RIVET GAP INSPECTION SHIM

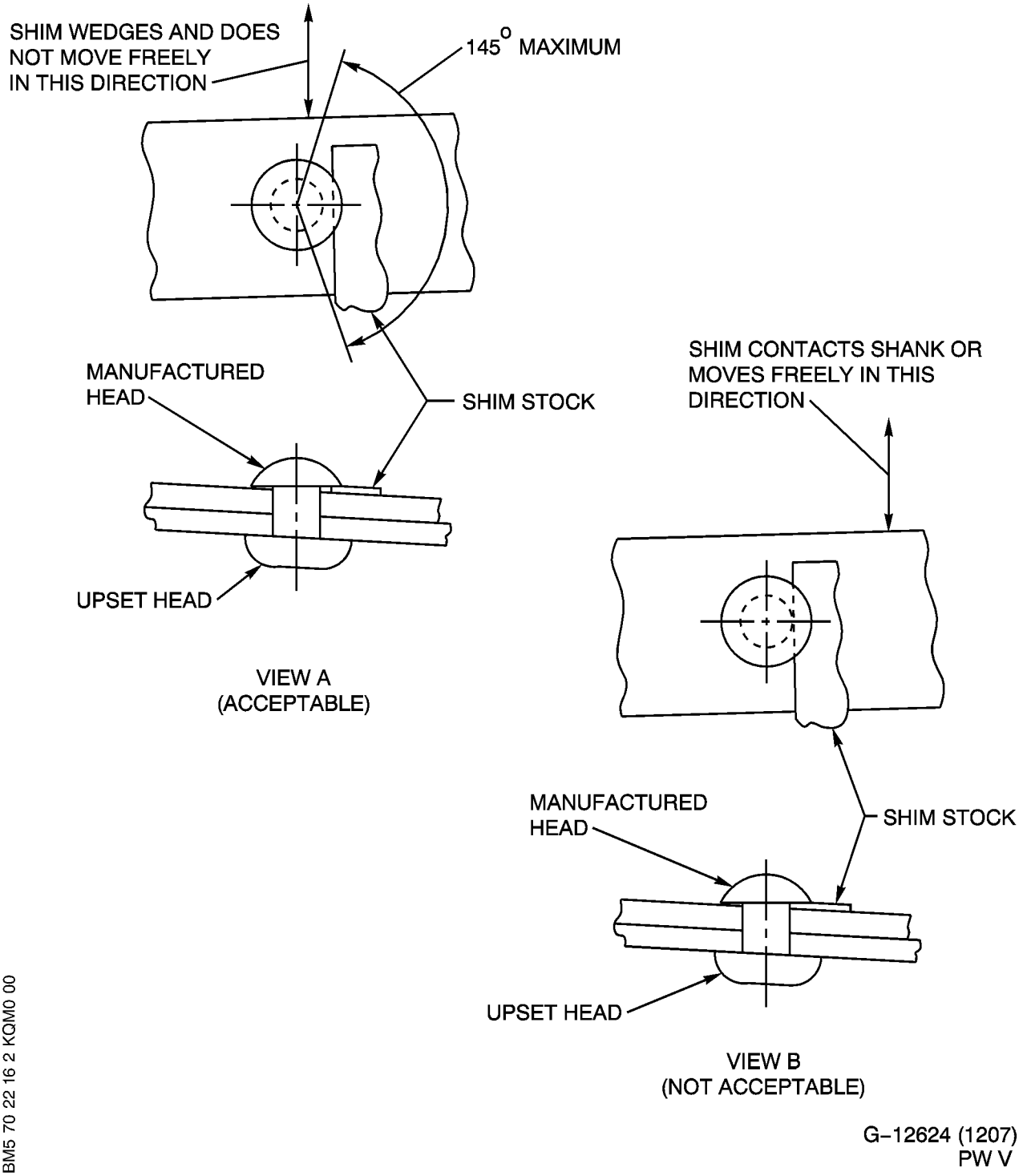


VIEW A

G-12623 (0807)
PW V

BM5 70 22 16 2 KPM0 00

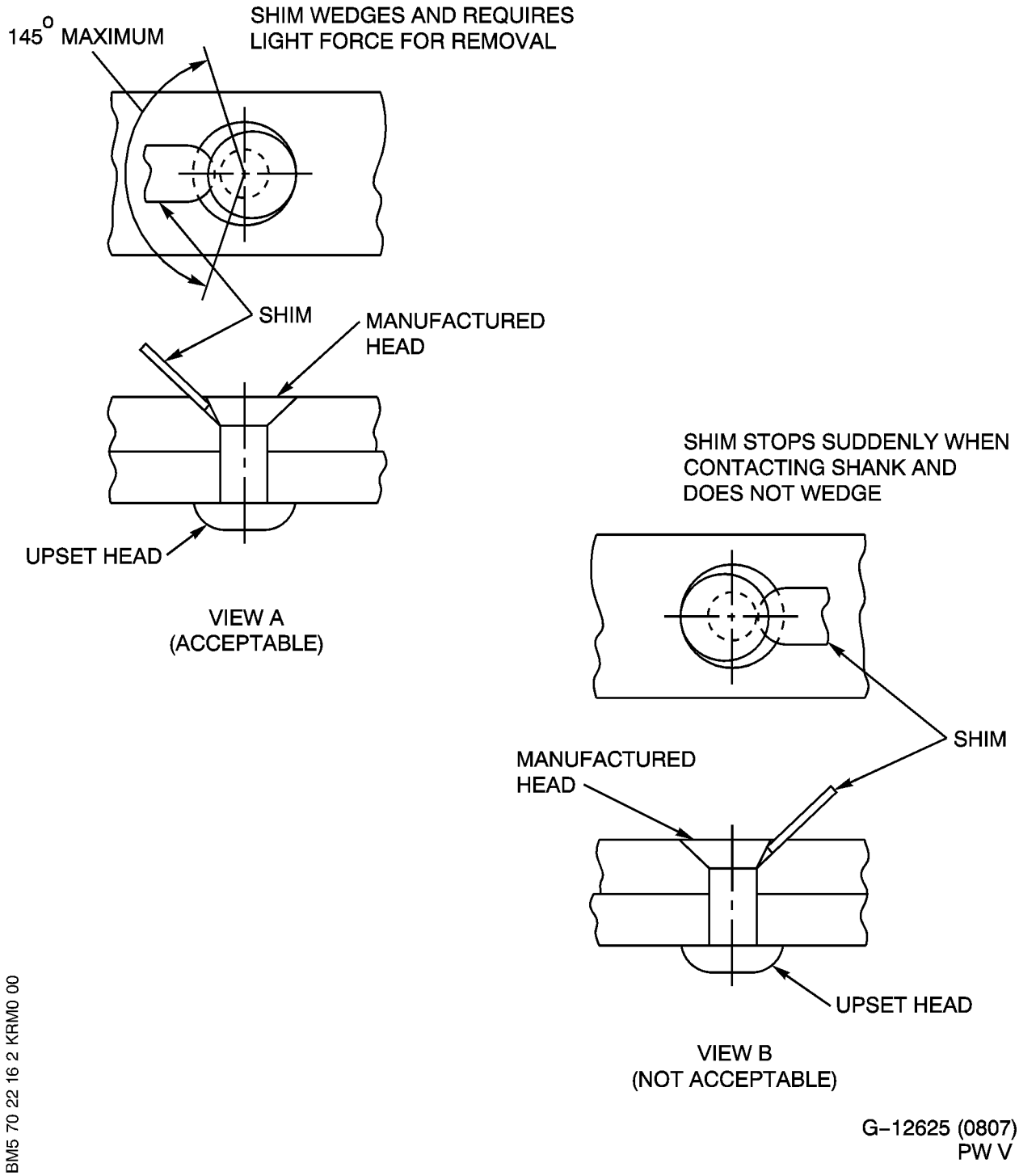
Flush Rivet and Protruding Rivet Open Heads
(Solid and Hollow)
Figure 214



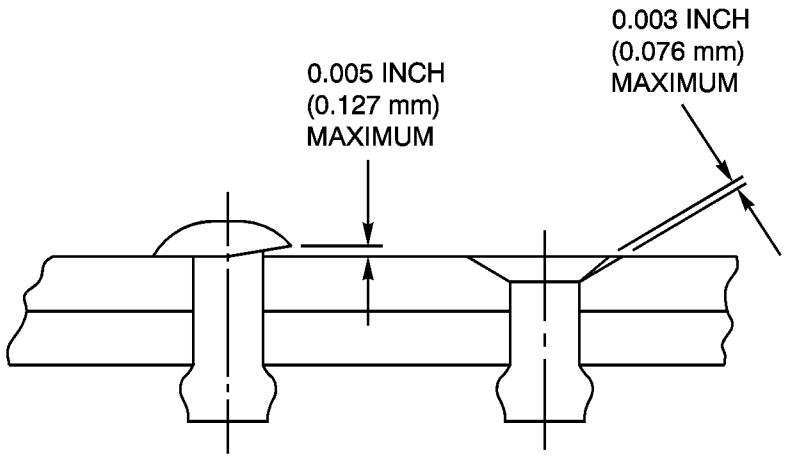
BM5 70 22 16 2 KQM0 00

G-12624 (1207)
PW V

Protruding Rivet Manufactured Head Gap
Figure 215



Flush Rivet Manufactured Head Gap
Figure 216

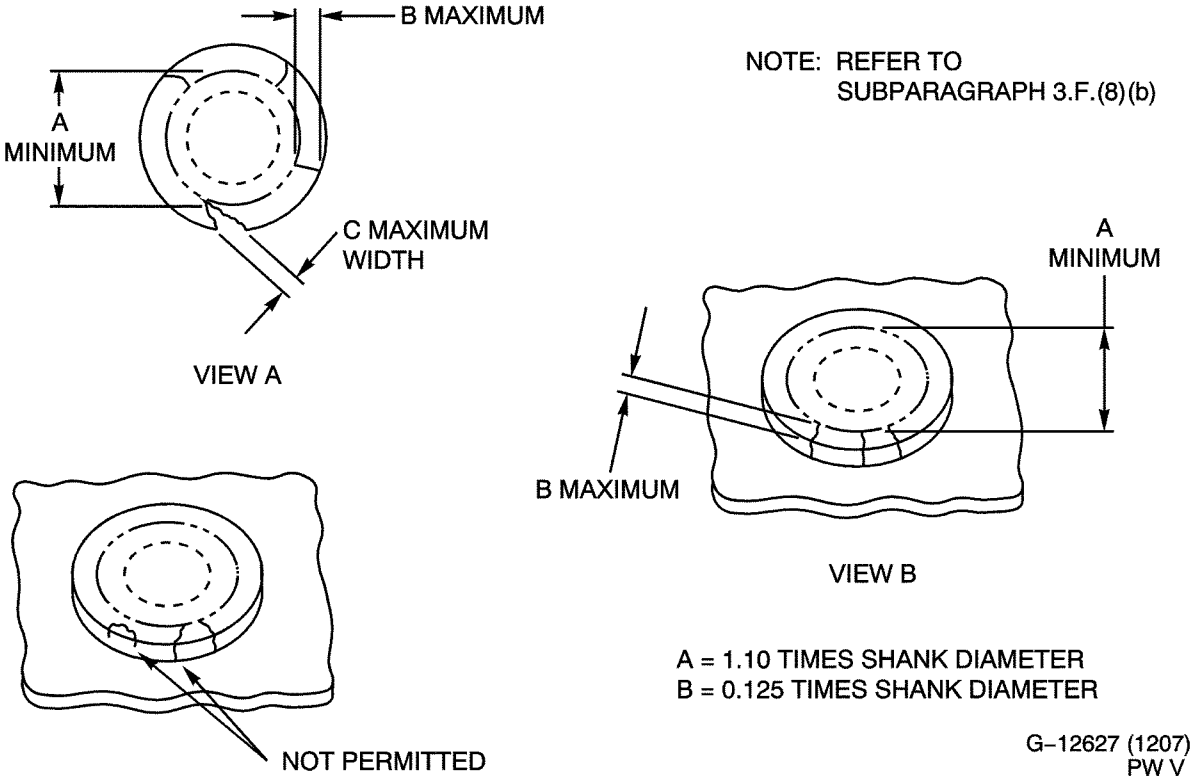


VIEW C

G-12626 (0807)
PW V

BM5 70 22 16 2 KSM0 00

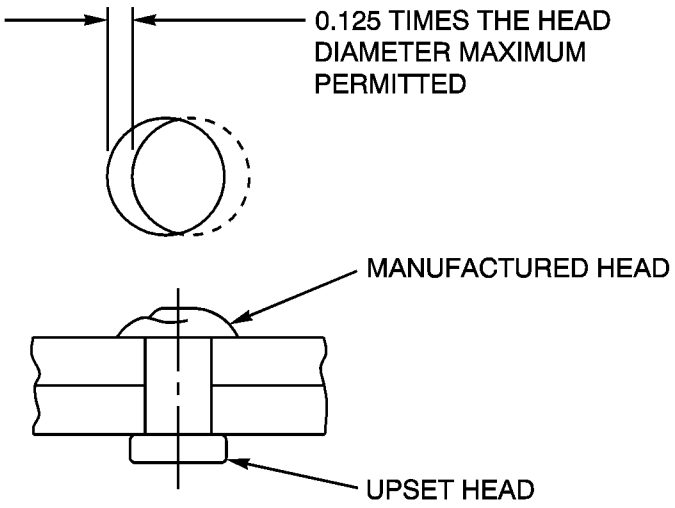
Open Head Protruding Rivet and Open Head
Flush Rivet, Bolts and Rivet Pins Gaps
Figure 217



NOMINAL RIVET DIAMETER (INCH)	A MIN. (INCH)	B MAX. (INCH)	C MAX. (INCH)
0.062	0.070	0.008	0.004
0.094	0.110	0.012	0.006
0.125	0.140	0.016	0.008
0.156	0.170	0.020	0.010
0.188	0.210	0.023	0.012
0.250	0.280	0.031	0.016
0.312	0.340	0.039	0.019
0.375	0.410	0.047	0.023

BM5 70 22 16 2 KTM0 00

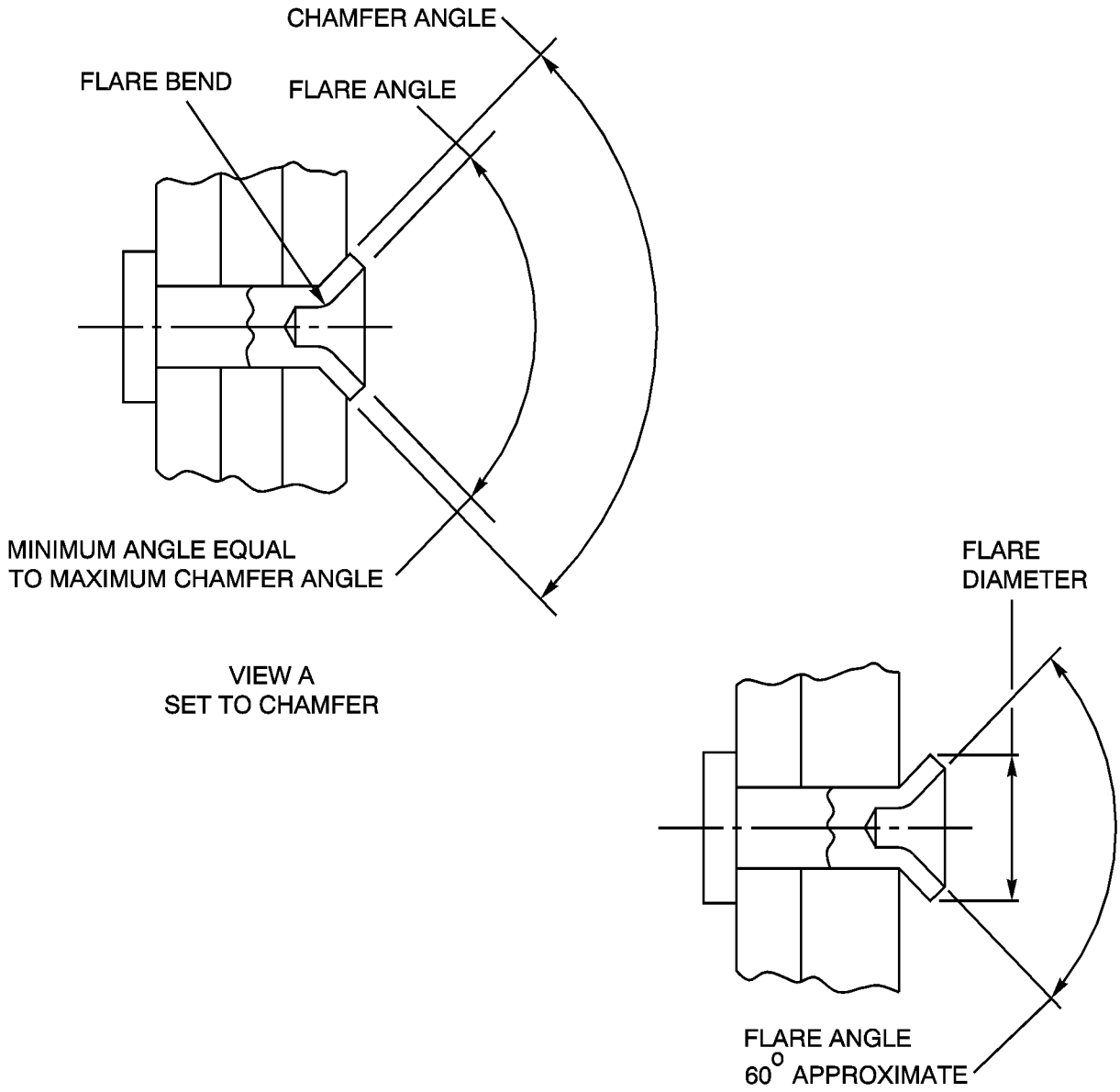
Upset Heads Crack Limits
Figure 218



BM5 70 22 16 2 KUM0 00

G-12628 (0807)
PW V

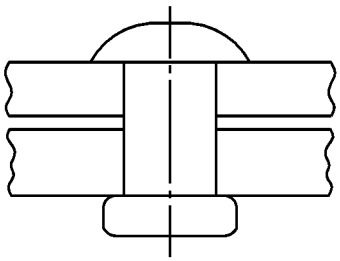
Protruding Rivet Manufactured Head Set Damage
Figure 219



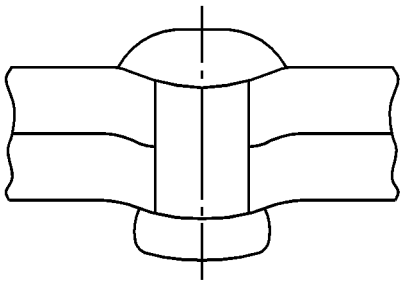
BM5 70 22 16 2 KVM0 00

G-12629 (0807)
PW V

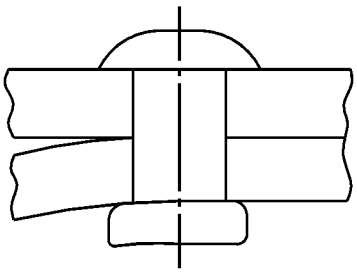
Hollow Rivet Flare Dimensions
Figure 220



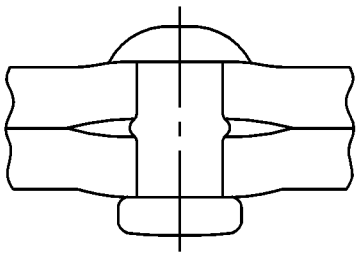
VIEW A



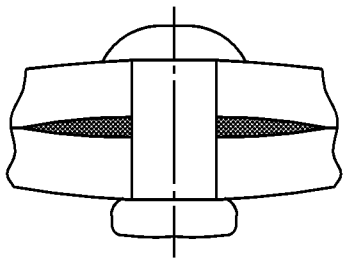
VIEW B



VIEW C



VIEW D

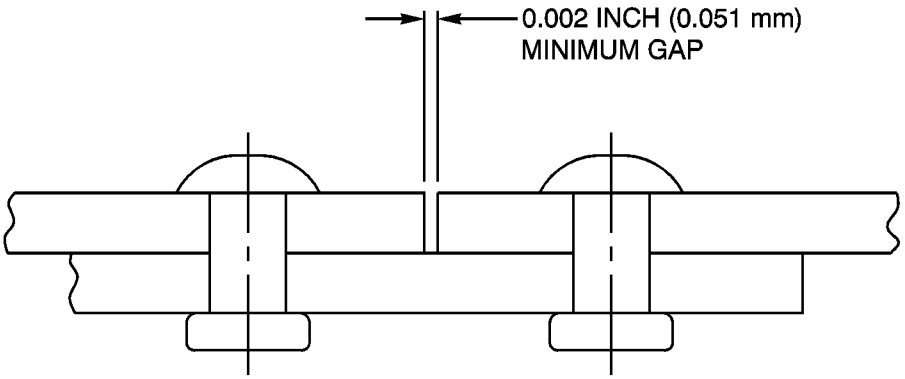


VIEW E

BM5 70 22 16 2 KWM0 00

G-12630 (0807)
PW V

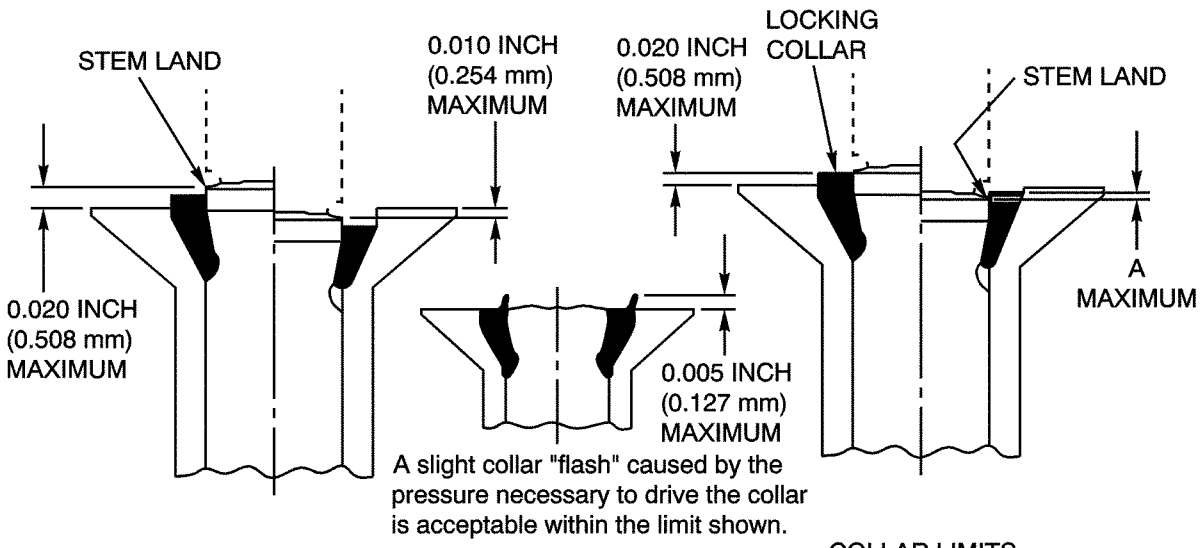
Unacceptable Sheet Displacement and Bulging
Figure 221



BM5 70 22 16 2 KXM0 00

G-12631 (0807)
PW V

GAP (in Inch) Between Adjacent Sheets
Figure 222



STEM LIMITS

Stem must never be more than .020 INCH (0.508 mm) above top of rivet head nor more than .010 INCH (0.254 mm) below top of rivet head. This applies to both flush and protruding head rivets. Dimensions shown are from the intersection of the rolled break notch and the stem locking land.

COLLAR LIMITS

The locking collar must not be more than .020 INCH (0.508 mm) above the top of the rivet head when the stem is above the rivet head. If the stem is flush or below flush with the rivet head, locking collar must not be more than "A" above the stem. This applies to both flush and protruding head rivets.

G-12632 (0807)
PW V

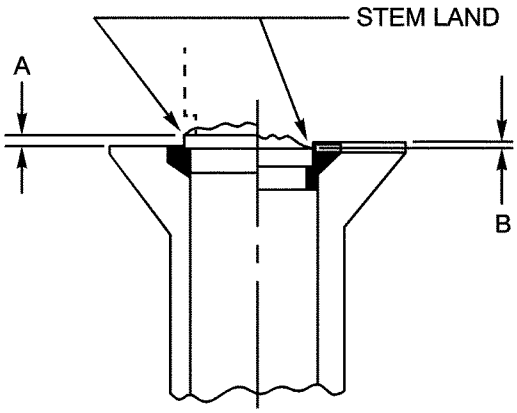
COLLAR LIMITS FOR A DIMENSION

NOMINAL RIVET DIA. (INCH)	A DIMENSION (MAXIMUM) (INCH)
0.125	0.015
0.156	0.020
0.188	0.025
0.250	0.030

NOTE: IF NOMINAL DIAMETER IS BETWEEN THE LISTED DIAMETERS, USE THE A DIMENSION FOR THE NEXT LARGER RIVET.

BM5 70 22 16 2 KYM0 00

Stem and Collar Flushness Limits
Figure 223



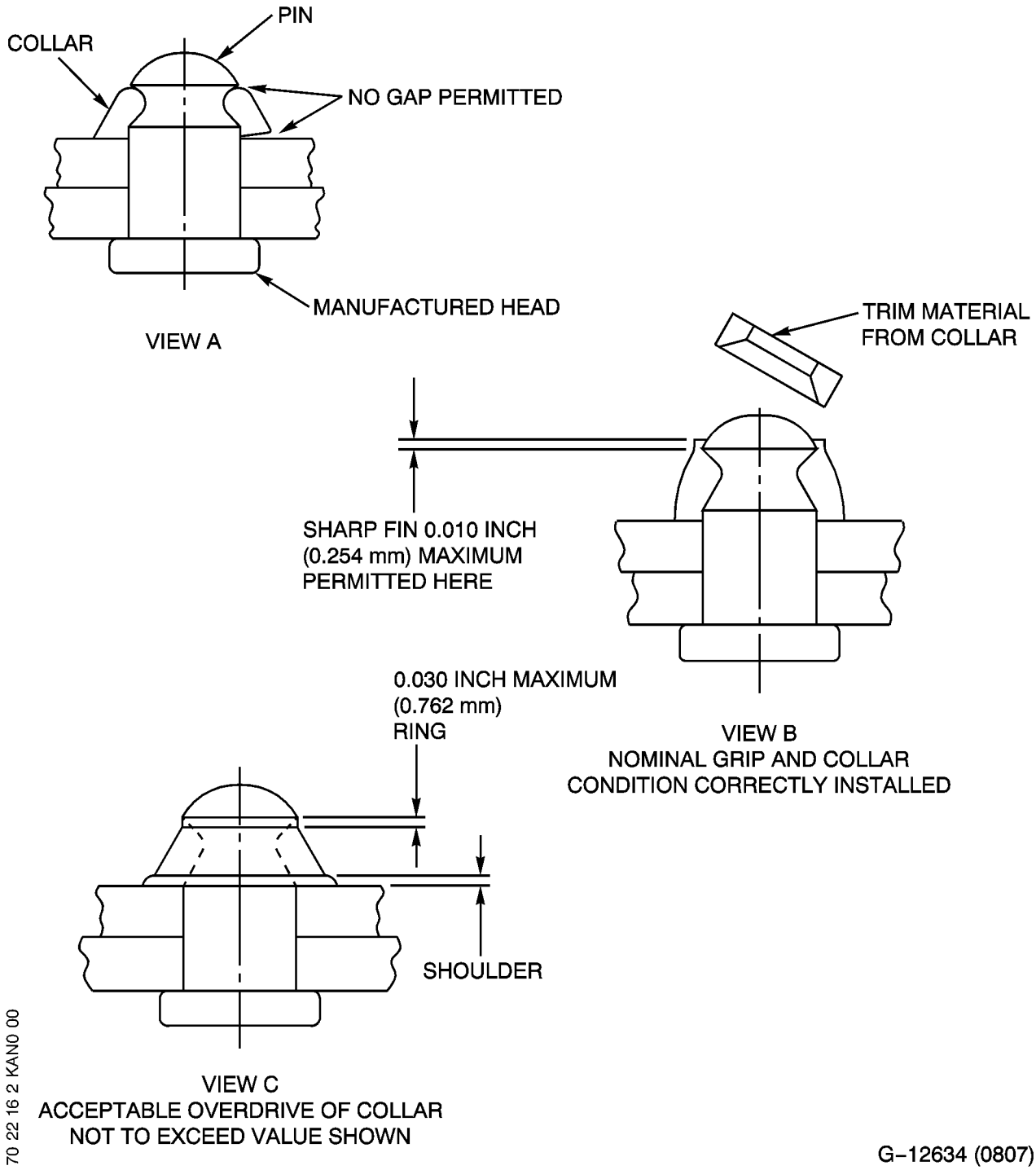
Stem must not be more than Dimension A above top of rivet head nor more than Dimension B below top of rivet head. This applies to both flush and protruding head rivets. Dimensions shown are from the intersection of the rolled break notch and the stem locking land.

G-12633 (0807)
PW V

BM5 70 22 16 2 KZM0 00

NOMINAL RIVET DIA. (INCH)	A DIMENSION (MAXIMUM) (INCH)	B DIMENSION (MAXIMUM) (INCH)
0.125	0.010	0.015
0.156	0.010	0.020
0.188	0.010	0.020
0.250	0.015	0.025

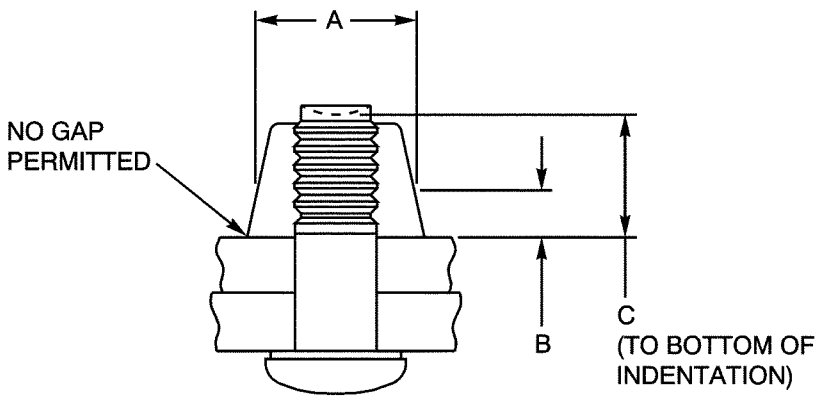
CherryMAX Stem Flushness
Figure 224



BM5 70 22 16 2 KAN0 00

G-12634 (0807)
PW V

Shear-Type Stump Rivet Pin
Figure 225

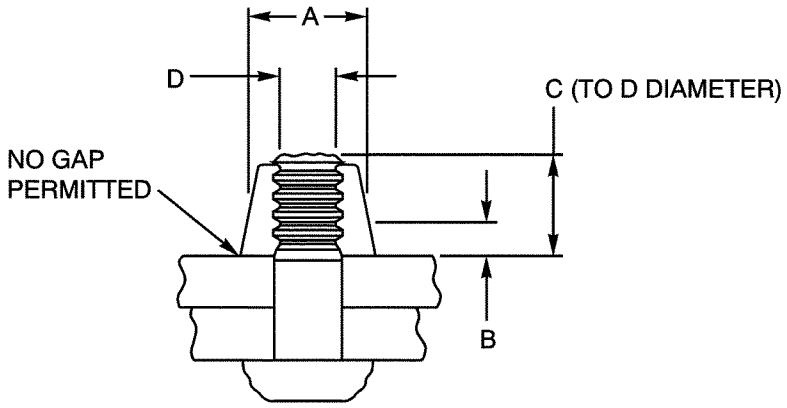


G–12635 (0807)
PW V

SIZE (INCH)	MATERIAL PIN	MATERIAL COLLAR	A MAX. (INCH)	B MAX. (INCH)	C MIN.- MAX. (INCH)
0.188	ALLOY, STAINLESS, AND CORROSION RESISTANT STEELS	CARBON STEELS	0.298	0.0675	0.238 - 0.323
0.250	ALLOY, STAINLESS, AND CORROSION RESISTANT STEELS	CARBON STEELS	0.395	0.0735	0.307 - 0.400

BM5 70 22 16 2 KBN0 00

Huck Tension Type Stump Rivet Pins - Swaged
Collar and Pin Projection Dimensions
Figure 226



G–12636 (0807)
PW V

SIZE (INCH)	MATERIAL PIN	MATERIAL COLLAR	A MAX. (INCH)	B MAX. (INCH)	C MIN.-MAX. (INCH)	D MAX. (INCH)
0.156	ALLOY, STAINLESS AND CORROSION RESISTANT STEELS	CARBON STEELS AND 2024 ALUMINUM	0.254	0.037	0.161-0.234	0.137
0.156	7075 ALUMINUM	6061 ALUMINUM	0.254	0.030	0.167-0.230	0.137
0.188	ALLOY, STAINLESS AND CORROSION RESISTANT STEELS	CARBON STEELS AND 2024 ALUMINUM	0.304	0.039	0.208-0.280*	0.165
0.188	ALLOY, STAINLESS AND CORROSION RESISTANT STEELS	STAINLESS AND CORROSION RESISTANT STEEL	0.286	0.081	0.200-0.280	0.165
0.188	7075 ALUMINUM	6061 ALUMINUM	0.304	0.039	0.208-0.280	0.165
0.250	ALLOY, STAINLESS AND CORROSION RESISTANT STEELS	CARBON STEELS AND 2024 ALUMINUM	0.401	0.038	0.295-0.374	0.225

*** WHEN YOU USE A ST1233-06 OR ST1305-06 PIN WITH A ST1234-06 COLLAR, THIS LIMIT DIMENSION IS 0.309 - 0.391 INCH (7.85 - 9.93 MM).**

BM5 70 22 16 2 KCN0 00

Huck Tension Type Pull Rivet Pins - Swaged
Collar and Pin Projection Dimensions
Figure 227

N. Tables (206 thru 210)

Countersink Hole Requirements (in Inch) for
Manufactured Head and Upset Head Rivets
Table 206

NOMINAL RIVET DIAMETER	FINAL HOLE DIAMETER FOR ALL SOLID AND HOLLOW RIVETS	TOP AND BOTTOM SHEET THICKNESS MINIMUM (REF. ONLY)	COUNTERSINK* DIAMETER A (RECOMMENDED)	COUNTERSINK DIAMETER F ± 0.005
0.062	0.064 - 0.068	0.032	0.100	0.095
0.094	0.096 - 0.100	0.040	0.165	0.141
0.125	0.128 - 0.132	0.050	0.211	0.189
0.156	0.159 - 0.163	0.063	0.272	0.236
0.188	0.191 - 0.195	0.080	0.339	0.288
0.250	0.253 - 0.255	0.100	0.462	0.380
0.312	0.315 - 0.317	0.125	0.550	0.470
0.375	0.379 - 0.381	0.160	0.680	0.565

* You can vary these dimensions to get the correct flushness.
NOTE : (Ref. Fig. 206) for manufactured head rivets and upset head rivets.

Upset Head Dimensions for AMS 5732, AMS 5737, AMS 7228, AMS 7229, AMS 7232, AMS 7233, AMS 7236, AMS 7237 or 2017-T4 Solid Rivets
Table 207

REF. DIA. CODE No.	NOMINAL RIVET SHANK DIA.	NOMINAL HEAD DIMENSIONS DIA. - HT.	DIAMETER MIN. - MAX.	HEIGHT MIN. - MAX.	MAX. VARIATIONS IN ANY ONE HEAD THICKNESS	B MAX. AMOUNT UPSET HEAD CAN EXTEND ONTO RADIUS
2	0.062	0.087 - 0.037	0.078 - 0.094	0.031 - 0.062	0.010	0.016
3	0.094	0.131 - 0.056	0.118 - 0.140	0.047 - 0.094	0.010	0.023
4	0.125	0.175 - 0.075	0.156 - 0.188	0.062 - 0.109	0.010	0.032
5	0.156	0.218 - 0.094	0.195 - 0.234	0.078 - 0.125	0.010	0.039
6	0.188	0.263 - 0.112	0.234 - 0.281	0.094 - 0.156	0.010	0.047
8	0.250	0.350 - 0.150	0.312 - 0.375	0.125 - 0.219	0.010	0.063
10	0.312	0.437 - 0.188	0.390 - 0.468	0.156 - 0.234	0.015	0.078
12	0.375	0.525 - 0.225	0.469 - 0.562	0.188 - 0.266	0.018	0.093

NOTE : Applicable rivet codes are AAD, AJH, BF, BO, DH, LM, LN, MM, MN, MO,SH, WT, WV, WW, WX, XA, XB, XC, XJ, XK, XL, XM, XN, XR, XT, XU, XV, XAL,XAM, XAN, XAR, XAO, and XAP.
See (Ref. Fig. 213)(View A) for measurement locations.

Upset Head Dimensions for AMS 7220, AMS 7222, AMS 7223, AMS 7225, or 5056-H32 Solid Rivets
Table 208

REF. DIA. CODE No.	NOMINAL RIVET SHANK DIA.	NOMINAL HEAD DIMENSIONS DIA. - HT.	DIAMETER MIN. - MAX.	HEIGHT MIN. - MAX.	MAX. VARIATIONS IN ANY ONE HEAD THICKNESS	B MAX. AMOUNT UPSET HEAD CAN EXTEND ONTO RADIUS
2	0.062	0.094 - 0.031	0.078 - 0.103	0.021 - 0.062	0.010	0.021
3	0.094	0.140 - 0.047	0.118 - 0.156	0.031 - 0.094	0.010	0.031
4	0.125	0.188 - 0.062	0.156 - 0.208	0.042 - 0.109	0.012	0.042
5	0.156	0.234 - 0.078	0.195 - 0.259	0.052 - 0.125	0.015	0.052
6	0.188	0.281 - 0.094	0.234 - 0.312	0.062 - 0.156	0.019	0.062
8	0.250	0.375 - 0.125	0.312 - 0.415	0.084 - 0.219	0.025	0.083
10	0.312	0.468 - 0.156	0.390 - 0.518	0.104 - 0.234	0.031	0.103
12	0.375	0.562 - 0.188	0.469 - 0.632	0.125 - 0.266	0.037	0.124

NOTE : Applicable rivet codes are A, ACZ, BA, BB, BC, BD, BE, BH, BJ, BK, BL, BM, CL, CX, CY, HF, LL, LO, LZ, MA, MB, MC, MK, XD, XE, XO, XP, MAF, MAV, and APZ.

See (Ref. Fig. 213)(View A) for measurement locations.

Minimum Edge Distance and Spacing of Rivets
for Inspection of Drilled Assemblies
Table 209

NOMINAL RIVET DIAMETER (INCH)	MINIMUM EDGE, DISTANCE FOR ALL HEAD TYPES (INCH)	MINIMUM SPACING, PROTRUDING HEAD (INCH)	MINIMUM SPACING, FLUSH HEAD (INCH)
0.062	0.130	0.160	0.220
0.094	0.190	0.250	0.340
0.125	0.250	0.340	0.470
0.156	0.310	0.440	0.600
0.188	0.370	0.530	0.720
0.250	0.500	0.720	0.970
0.312	0.620	0.880	1.220
0.375	0.750	1.060	1.470

NOTE : Edge distance is from the edge of the sheet to the centerline of the rivet hole.
See (Ref. Fig. 213)(View A) for measurement locations.

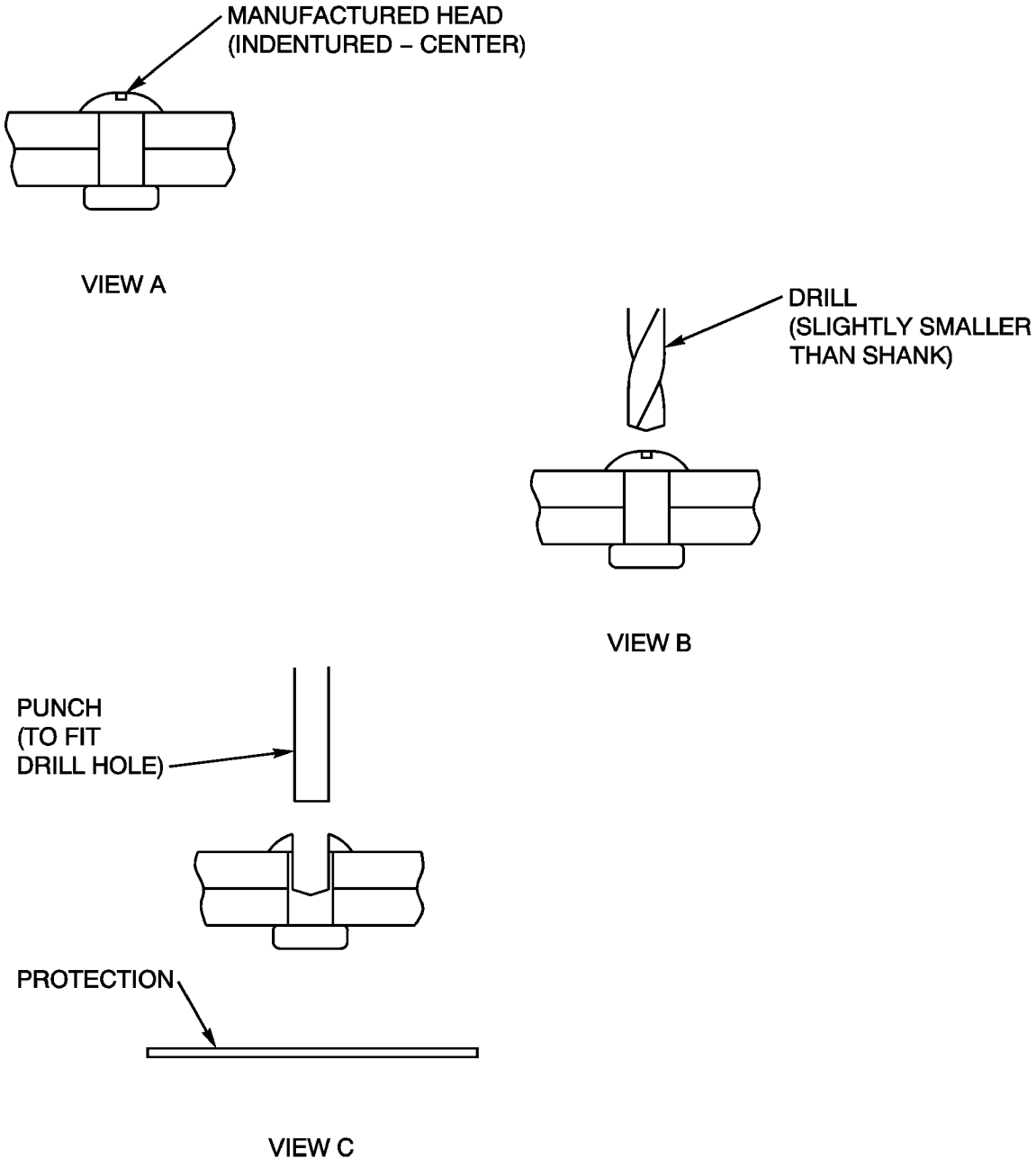
Typical Load Required to Push Out the Installed and Lock Stem
Table 210

NOMINAL RIVET DIAMETER (INCH)	TOTAL LOAD (LBF)
0.125	100
0.156	150
0.188	225
0.250	300

7. Rivet Removal Procedure

A. Job Set-Up
(1)Not applicable.

B. General (Ref. Fig. 228)
(1)Make sure that you remove and install protection covers as necessary to prevent damage to the adjacent surfaces and to prevent rivet parts from entering into open area, cavities, holes, and ports.
(2)Carefully remove rivets to prevent damage to the detail parts (Ref. Fig. 228).
CAUTION : DO NOT GRIND. IF YOU DO THEN YOU CAN CAUSE DAMAGE TO THE DETAIL PARTS.
R (3)Unless specified differently in the repair, you must carefully drill
R out rivets. Do not grind. Typical tools include center-punch, drill,
R and blind rivet removal too available from Avery Tool, Grangier, and
R Starrett.
R NOTE : The tools are available from :
R Avery Tools
R 111 Aviator Drive
R Fort Worth, TX 76179 USA
R www.averytools.com
R Tel : 1-800-OK-AVERY or 1-800-652-8379 (for orders)
R Tel : 1-817-439-8400 (general office)
R Fax : 1-817-439-8402
R
R Grainger Industrial Supply
R 100 Grainger Parkway
R Lake Forest, IL 60045 USA
R www.grainger.com
R Tel : 1-800-468-8326
R Fax : 1-877-994-1969
R
R Starrett
R LOCAL PURCHASE (for center punch)
R (a)If there is no center indentation, use the blind rivet removal
R tool and obey the manufacturer's instructions or do the subsequent
R procedure :
R 1 Center-punch the rivet for the start of drilling in the
R manufactured head (Ref. Fig. 228)(View A).
R 2 Use a drill size slightly smaller than the rivet shank diameter. Keep the drill perpendicular to the surface and drill through the head and slightly into the rivet shank. Do not drill into the rivet base structure. Do not oversize the rivet hole (Ref. Fig. 228)(View B).
R 3 Put a protection pad under the rivet to help catch the rivet head. Use a punch, the same size as the drill (or slightly smaller), to punch out the upset head. (Ref. Fig. 228)(View C).
R 4 Remove the rivet heads and all remaining unwanted material.



BM5 70 22 16 2 KDN0 00

G–12699 (0808)
PW V

R Riveting (Rivet Removal)
Figure 228

POWER PLANT WIRING STANDARD PRACTICES
DESCRIPTION AND OPERATION

1. General

A. All the data in Chapter/Section 70-71 is related to the wiring on the Pratt and Whitney PW4152, PW4156A or PW4158 Power Plant only and is applicable to whichever model is installed on the A310 or A300-600 aircraft.

R WIRING - GENERAL - DESCRIPTION AND OPERATION

1. General Wiring Information

A. General

(1) These procedures give repair data on the power plant electrical harnesses. Repairs to the harnesses consist of splicing of wires in the wire bundles, splicing of cables and replacement of connectors, backshells and contacts.

(2) The electrical harnesses can contain a single conductor unshielded and multi-conductor shielded type wires. Do the applicable repairs.

(3) Replace the repaired harness when the harness is removed or during the next shop visit.

(4) Do not splice generator power feeder cables or cables with an outer steel braid.

(5) Splices must be moisture and abrasion resistant. Use a moisture resistant tape wrap covered with an abrasion resistant tape wrap as specified in the repair task.

(6) You must see the wire splice to do a visual inspection. Do not put the wire splices under clamps or drip loops.

NOTE : Shielding where used, is very important and must be continuous across all the wire splices.

WIRING - CONNECTOR/INSERT ARRANGEMENT - DESCRIPTION AND OPERATION

1. Connector/Insert Arrangement

A. General

(1)This chapter gives the supplier part number, part number description, alternate keying positions and contact arrangements for the connectors used on the power plant.

B. Connectors Used

(1)Modified MIL-C-26500 series used with CN0966 and CN0967 connectors.
(2)Modified MIL-C-26500 series used with FPK connectors.
(3)D38999 series connectors.
(4)EN2997 series connectors.
(5)M83723 series connectors.
(6)MS3459 series connectors.

C. Insert Arrangement

NOTE : The insert arrangement is determined by the connector shell size and the contact arrangement.

(1)If the front face of a pin insert is shown, the rear face of the pin insert is the opposite.
(2)If the front face of a socket insert is shown, the rear face of the socket insert is the opposite.

D. Mating

NOTE : The mating of one series of connector series with another different series of connector is not permitted.

(1)Examples
(a)The modified MIL-C-26500 series connector must be used with another modified MIL-C-26500 connector.
(b)The M83723 connector must be used with another M83723 connector.
(c)The EN2997 connector must be used with another EN2997 connector.
(2)Do not mate one of these series of connectors together with a different series of connector. It could cause a possible loss of protection quality to the connector.

E. Modified MIL-C-26500 Connectors

(Ref. Fig. 001)
(Ref. Fig. 002)
(Ref. Fig. 003)
(Ref. Fig. 004)
(Ref. Fig. 005)

(1)The supplier part numbers CN0966 and CN0967 are modified MIL-C-26500 series standard and firewall connectors.
(2)An example of the supplier identification number is CN0966B12S03PN :

CN0966B12S03PN (example)

CN0966 = Connector Type
CN0966 = Plug (self-locking)
CN0967 = Receptacle (square flange mount)

CN0966B12S03PN (example)

B = Series Modification
B = Rear accessory thread per MS3155 with EMI band
C = Rear accessory thread per MS3155

12 = Shell Size
10, 12, 14, 16, 18, 20, 24 and 28

S = Environment Class
K = Stainless steel firewall
S = Stainless steel

03 = Insert Arrangement
10-05, 12-03, 14-07, 16-10, 18-14, 20-16, 22-19, 24-30, 28-42

P = Contact Style
P = Pin
S = Socket

N = Alternate Keying
N = Normal, 6, 7, 8, 9 and 10

NOTE : A parenthesis is located on the face of the connector around each tenth contact hole.

F. Modified MIL-C-26500 Connectors
(Ref. Fig. 001)
(Ref. Fig. 002)
(Ref. Fig. 003)
(Ref. Fig. 004)
(Ref. Fig. 005)
(1)The supplier part number FPK is a modified MIL-C-26500 series firewall connector.
(2)An example of the supplier identification number is FPK-12F14-07PN :

FPK-12F14-07PN (example)

FPK = Connector Type
FPK = Stainless steel firewall class K connector

12 = Shell Type
12 = Plug (self-locking)
17 = Receptacle (square flange mount)

F = Series Modification
E = Rear accessory thread per MS3155
F = Rear accessory thread per MS3155 with EMI band

14 = Shell Size
14, 18, 22, 24 and 28

07 = Insert Arrangement
14-07, 18-14, 22-19, 24-30, 28-42

P = Contact Style
P = Pin
S = Socket

N = Alternate Keying
N = Normal, 6, 7, 8 and 9

NOTE : A parenthesis is located on the face of the connector around each tenth contact hole.

G. MIL-C-83723 Connectors
(Ref. Fig. 001)
(Ref. Fig. 006)
(Ref. Fig. 007)
(1)The supplier part number M83723 is a MIL-C-83723 series III connector.
(2)An example of the supplier identification number is M83723/97S18146 :

M83723/97S18146 (example)

M83723 = Connector Type

97 = Shell/Contact Style
97 = Rear accessory thread per MS3155 with EMI band

S = Class
S = Stainless steel firewall

18 = Shell Size
10 and 18

14 = Insert Arrangement
10-05 and 18-14

6 = Alternate Keying
N = Normal and 6

H. MIL-C-83723 Connectors
(Ref. Fig. 001)
(Ref. Fig. 006)
(Ref. Fig. 007)
(Ref. Fig. 008)
(1)The AECMA specification EN2997 is a modified MIL-C-83723 series III connector.
(2)An example of the supplier identification number is EN2997S610-05MN :

EN2997S610-05MN (example)

EN2997 = Connector Series
EN2997 = AECMA designation

S = Class
Standard Temperature (200 deg. C) :
K = Stainless steel firewall
S = Stainless steel firewall with EMI band on the plug
High Temperature (260 deg. C) :
SE = Stainless steel firewall with EMI band on the plug

6 = Shell Style
6 = Plug (self-locking) rear accessory thread per MS3155

10 = Shell Size
8, 9, 10, 12, 14, 16 and 18

05 = Insert Arrangement
08-03, 10-05, 12-03, 12-07, 12-12, 14-15, 16-20, 16-24, 18-31 and 20-41

M = Contact Style
M = Pin
S = Socket

N = Alternate Keying
N = Normal, 6, 7, 8 and 9

J. MIL-C-38999 Connectors
(Ref. Fig. 009)
(Ref. Fig. 010)
(1)The supplier part number D38999 is a MIL-C-38999 series III connector.
(2)An example of the supplier identification number is D38999/26KA19SN :

D38999/26KA19SN (example)

D38999 = Connector Type

26 = Shell Style
26 = Plug (self-locking)

K = Class

D38999/26KA19SN (example)

K = Stainless steel firewall

A = Shell Size
A = 09

19 = Insert Arrangement
9-98 and 15-19

S = Contact Style
P = Pin
S = Socket

N = Alternate Keying
N = Normal and A

K. MIL-C-5015 Connectors
(Ref. Fig. 011)
(Ref. Fig. 012)
(1)The number MS3459 is a MIL-C-5015 connector.
(2)An example of the supplier identification number is MS3459KS12S-3S :

MS3459KS12S-3S (example)

MS3459 = Connector Type
MS3459 = Plug (self-locking)

KS = Class
KS = Firewall, stainless steel, passivated, non-flammable hard dialectric and fluid resistant plug

12S = Shell Size
12 and 14

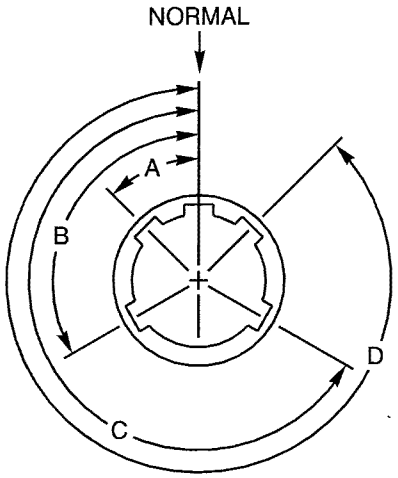
3 = Insert Arrangement
3 and 7

S = Contact Style
P = Pin
S = Socket

- Alternate Keying
Blank = Normal

ALTERNATE POLARITY KEYWAY ARRANGEMENTS

THIS IS A VIEW OF THE FRONT FACE OF THE RECEPTACLE SHELL. THE ANGLES ARE COUNTERCLOCKWISE FROM THE NORMAL KEYWAY. FOR THE PLUG SHELL, THE KEY LOCATIONS ARE CLOCKWISE WHEN YOU VIEW THE PLUG FROM THE FRONT FACE.



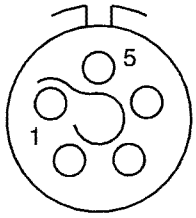
POSITION	FOR CONNECTORS SIZE 8 AND 10				FOR CONNECTORS SIZE 12, 14, 16, 18, 20, 22, 24 AND 28			
	A	B	C	D	A	B	C	D
NORMAL	105^{o}	140^{o}	215^{o}	265^{o}	105^{o}	140^{o}	215^{o}	265^{o}
6	102^{o}	132^{o}	248^{o}	320^{o}	18^{o}	149^{o}	192^{o}	259^{o}
7	80^{o}	118^{o}	230^{o}	312^{o}	92^{o}	152^{o}	222^{o}	342^{o}
8	35^{o}	140^{o}	205^{o}	275^{o}	84^{o}	152^{o}	204^{o}	334^{o}
9	64^{o}	155^{o}	234^{o}	304^{o}	24^{o}	135^{o}	199^{o}	240^{o}
Y(10*)	25^{o}	115^{o}	220^{o}	270^{o}	98^{o}	152^{o}	268^{o}	338^{o}

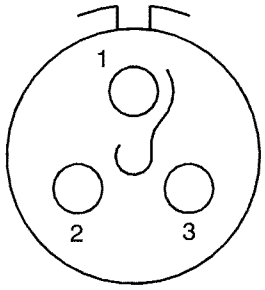
*NOT AVAILABLE IN SIZE 8 CONNECTOR

BM5 70 71 12 0 KAM0 00

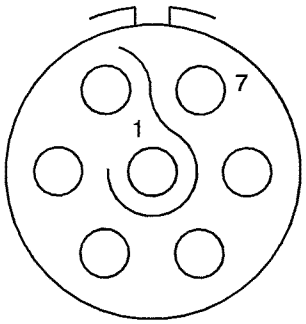
G – 02023 (0000)
PW V

MIL-C-83723, EN29977 and Modified MIL-C-26500
Connectors (Alternate Keying Positions)
Figure 001

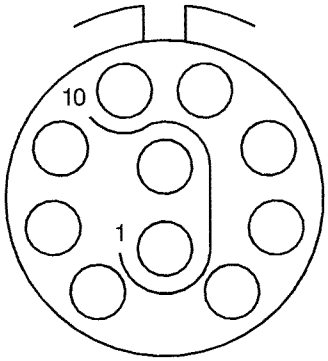




CONTACT ARRANGEMENT	10 – 05	12 – 03
NUMBER OF CONTACTS	5	3
SIZE OF CONTACTS	NO. 20	NO. 16



14 – 07
7
NO. 16



16 – 10
10
NO. 16

THE VIEW OF THE CONNECTOR IS MADE LARGER FOR IDENTIFICATION OF THE CONTACT LOCATIONS.

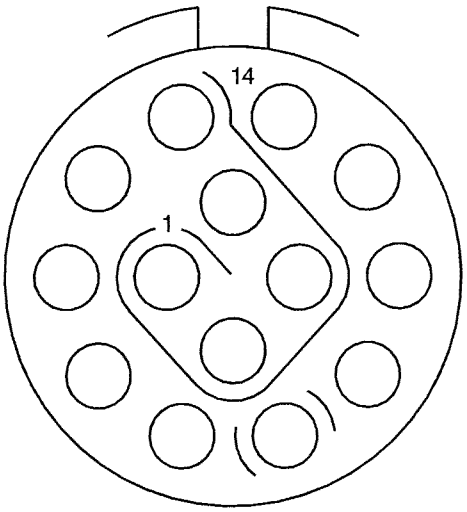
FRONT FACE OF SOCKET INSERT IS SHOWN, REAR FACE OF SOCKET INSERT IS OPPOSITE

G – 02024 (0000)
PW V

BM5 70 71 12 0 KBM0 00

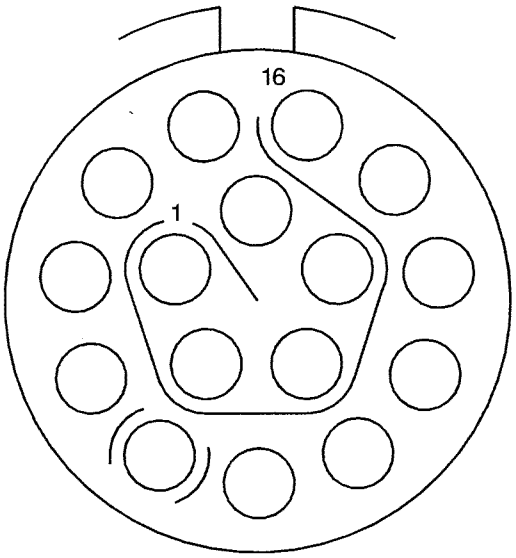
Modified MIL-C-26500 Connector Contact Arrangements
Figure 002

FRONT FACE OF SOCKET INSERT IS SHOWN,
REAR FACE OF SOCKET INSERT IS OPPOSITE



CONTACT ARRANGEMENT	18 – 14
NUMBER OF CONTACTS	14
SIZE OF CONTACTS	NO. 16

THE VIEW OF THE CONNECTOR IS
MADE LARGER FOR IDENTIFICATION
OF THE CONTACT LOCATIONS



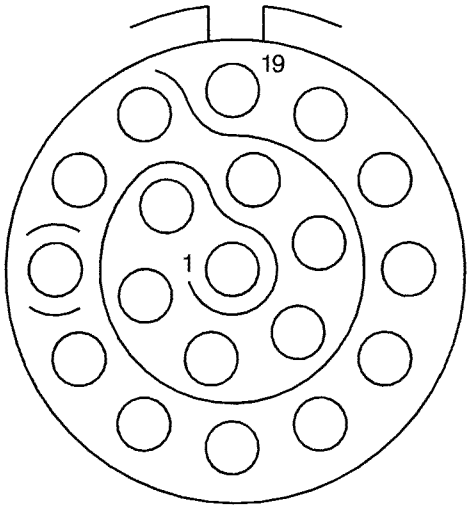
	20 – 16
	16
	NO. 16

G – 02025 (0000)
PW V

BM5 70 71 12 0 KCM0 00

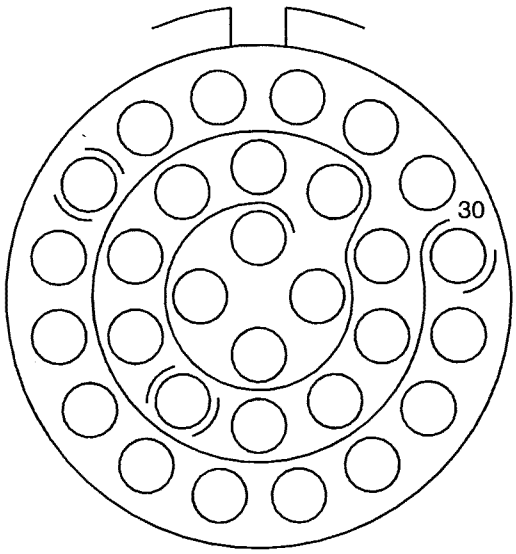
Modified MIL-C-26500 Connector Contact Arrangements
Figure 003

FRONT FACE OF SOCKET INSERT IS SHOWN,
REAR FACE OF SOCKET INSERT IS OPPOSITE



CONTACT ARRANGEMENT	22 – 19
NUMBER OF CONTACTS	19
SIZE OF CONTACTS	NO. 16

THE VIEW OF THE CONNECTOR IS
MADE LARGER FOR IDENTIFICATION
OF THE CONTACT LOCATIONS



	24 – 30
	30
	NO. 16

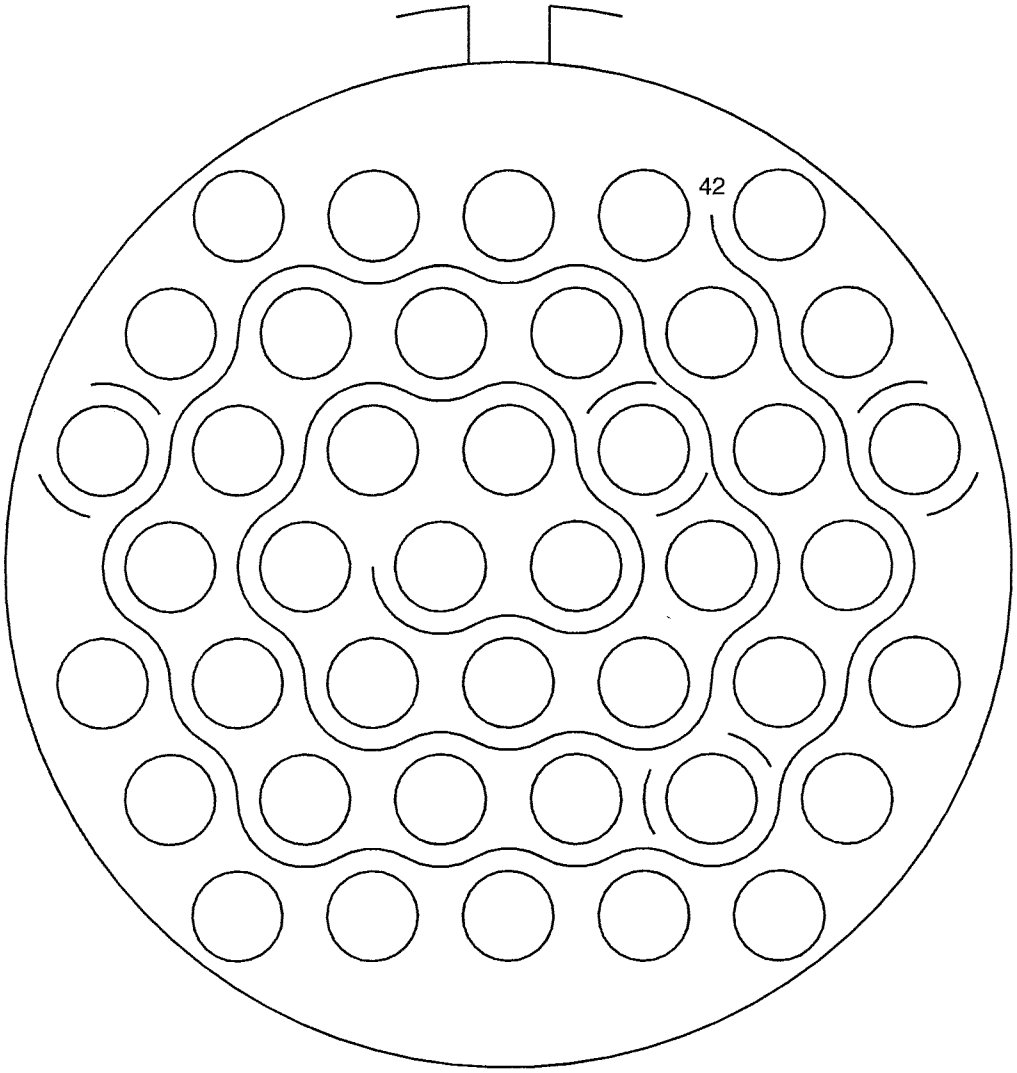
G – 02026 (0000)
PW V

BM5 70 71 12 0 KDM0 00

Modified MIL-C-26500 Connector Contact Arrangements
Figure 004

THE VIEW OF THE CONNECTOR IS MADE LARGER FOR IDENTIFICATION OF THE CONTACT LOCATIONS

FRONT FACE OF SOCKET INSERT IS SHOWN, REAR FACE OF SOCKET INSERT IS OPPOSITE



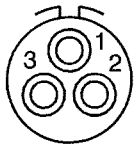
CONTACT ARRANGEMENT	28 – 42
NUMBER OF CONTACTS	42
SIZE OF CONTACTS	NO. 16

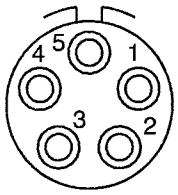
G – 02027 (0000)
PW V

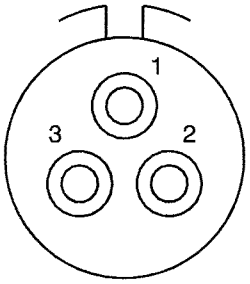
BM5 70 71 12 0 KEM0 00

Modified MIL-C-26500 Connector Contact Arrangements
Figure 005

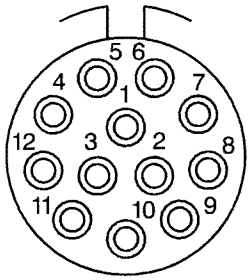
FRONT FACE OF PIN INSERT IS SHOWN,
REAR FACE OF PIN INSERT IS OPPOSITE

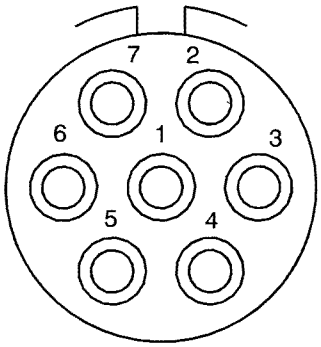


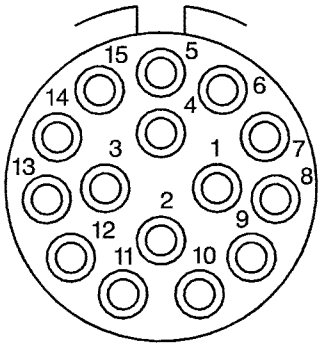




CONTACT ARRANGEMENT	08 – 03	10 – 05	12 – 03
NUMBER OF CONTACTS	3	5	3
SIZE OF CONTACTS	NO. 20	NO. 20	NO. 16







12 – 12	14 – 07	14 – 15
12	7	15
NO. 20	NO. 16	NO. 20

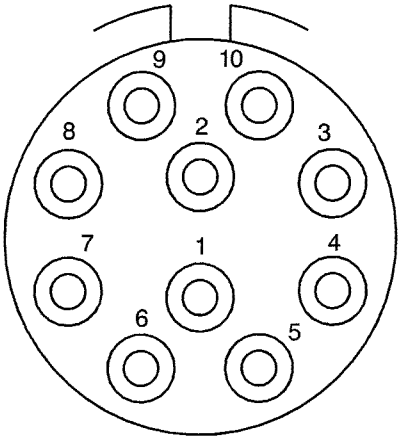
THE VIEW OF THE CONNECTOR IS
MADE LARGER FOR IDENTIFICATION
OF THE CONTACT LOCATIONS

G – 02030 (0000)
PW V

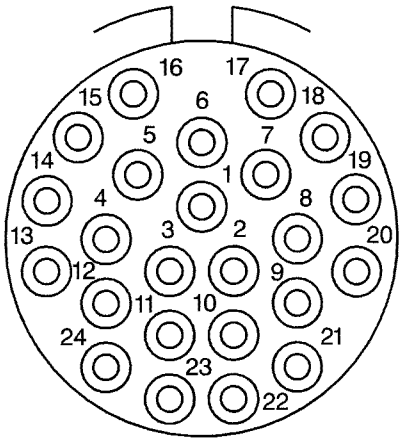
BM5 70 71 12 0 KFM0 00

MIL-C-83723 and EN2997 Connector Contact Arrangements
Figure 006

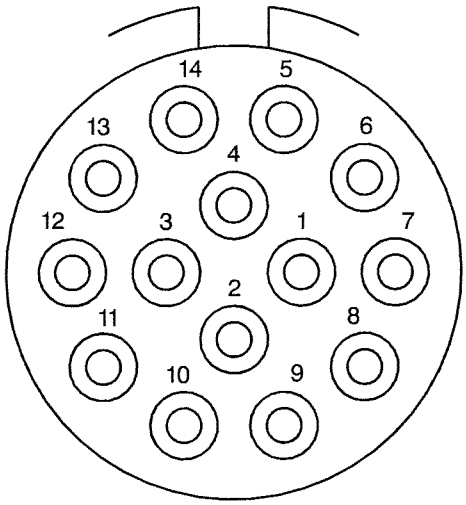
FRONT FACE OF PIN INSERT IS SHOWN,
REAR FACE OF PIN INSERT IS OPPOSITE



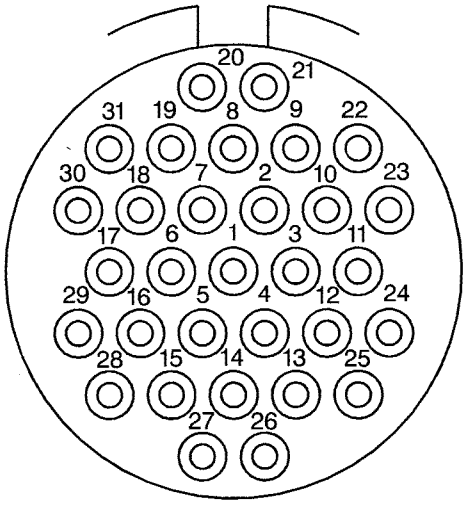
CONTACT ARRANGEMENT	16 – 10
NUMBER OF CONTACTS	10
SIZE OF CONTACTS	NO. 16



16 – 24	
24	
NO. 20	



18 – 14
14
NO. 16



18 – 31
31
NO. 20

THE VIEW OF THE CONNECTOR IS
MADE LARGER FOR IDENTIFICATION
OF THE CONTACT LOCATIONS

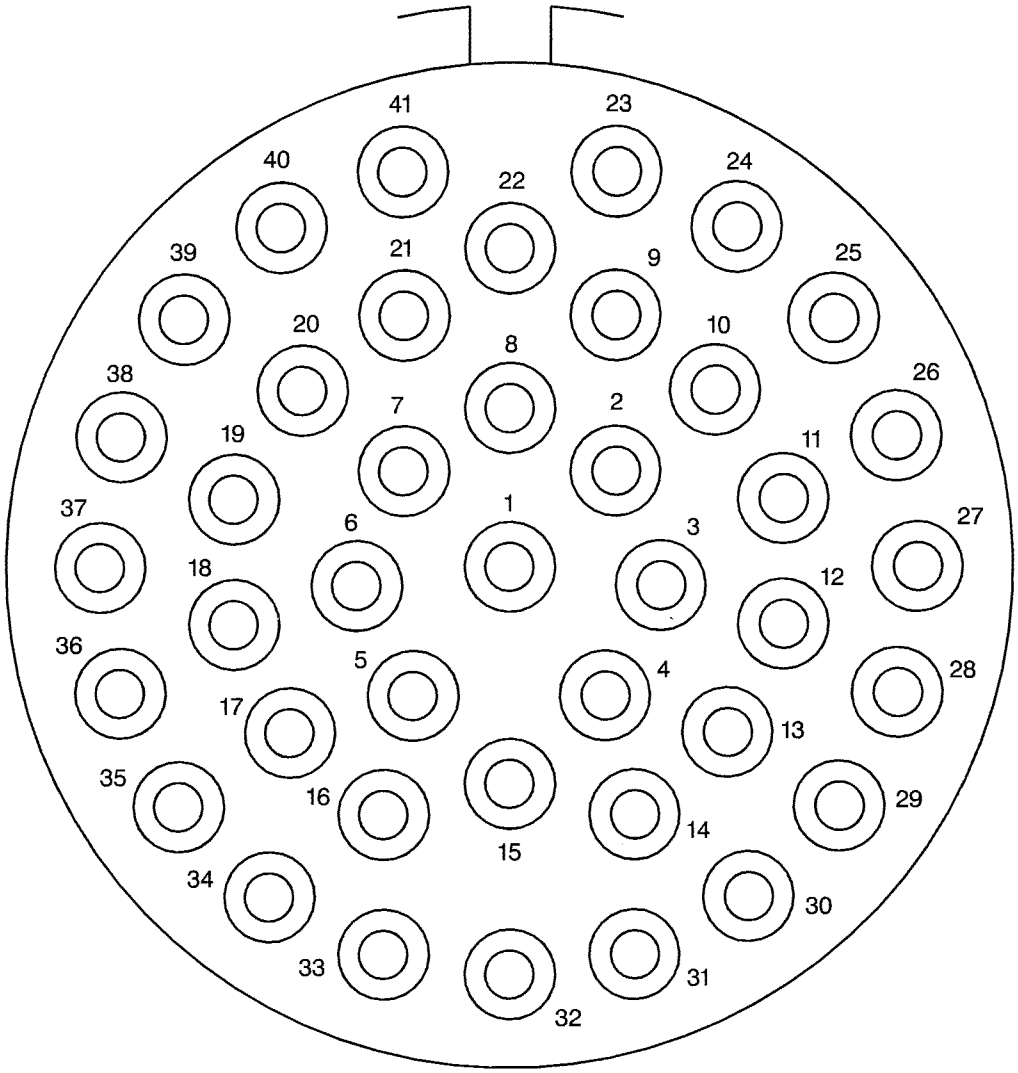
G – 02031 (0000)
PW V

BM5 70 71 12 0 KGM0 00

MIL-C-83723 and EN2997 Connector Contact Arrangements
Figure 007

THE VIEW OF THE CONNECTOR IS MADE LARGER FOR IDENTIFICATION OF THE CONTACT LOCATIONS

FRONT FACE OF PIN INSERT IS SHOWN, REAR FACE OF PIN INSERT IS OPPOSITE



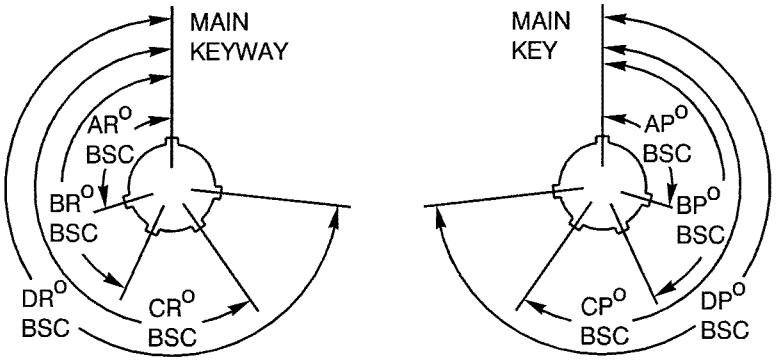
CONTACT ARRANGEMENT	20 – 41
NUMBER OF CONTACTS	41
SIZE OF CONTACTS	NO. 20

G – 02032 (0000)
PW V

BM5 70 71 12 0 KHM0 00

MIL-C-83723 and EN2997 Connector Contact Arrangements
Figure 008

ALL THE ANGLES ARE BASIC. MAIN KEYS/KEYWAYS AND INSERTS ARE FIXED IN NORMAL KEY POSITION. THE AUXILIARY KEY/KEYWAYS ARE MOVED FOR ALTERNATE KEYING.



RECEPTACLE (Front face shown)

PLUG (Front face shown)

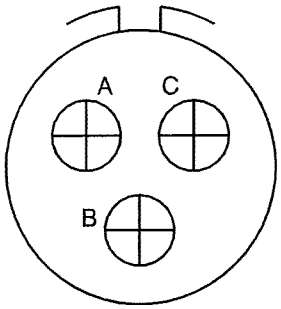
MAIN KEY/KEYWAY POLARIZATION

SHELL SIZE	KEY & KEYWAY ARRANGEMENT IDENTIFICATION LETTER	AR^{O} OR AP^{O} BSC	BR^{O} OR BP^{O} BSC	CR^{O} OR CP^{O} BSC	DR^{O} OR DP^{O} BSC
9	N	105	140	215	265
	A	102	132	248	320
	B	80	118	230	312
	C	35	140	205	275
	D	64	155	234	304
	E	91	131	197	240
11, 13 AND 15	N	95	141	208	236
	A	113	156	182	292
	B	90	145	195	252
	C	53	156	220	255
	D	119	146	176	298
	E	51	141	184	242
17 AND 19	N	80	142	196	293
	A	135	170	200	310
	B	49	169	200	244
	C	66	140	200	257
	D	62	145	180	280
	E	79	153	197	272
21, 23 AND 25	N	80	142	196	293
	A	135	170	200	310
	B	49	169	200	244
	C	66	140	200	257
	D	62	145	180	280
	E	79	153	197	272

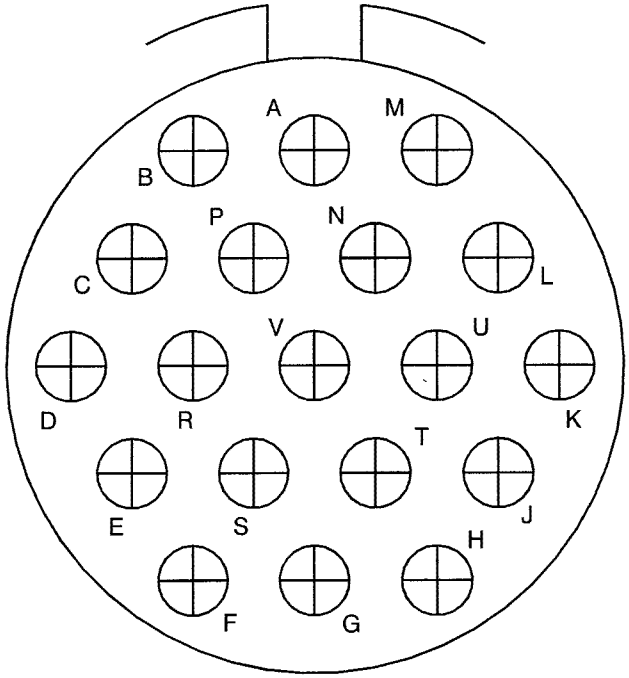
BM5 70 71 12 0 KJM0 00

G – 02028 (0000)
PW V

MIL-C-38999 Connectors (Alternate Keying Positions)
Figure 009



CONTACT ARRANGEMENT	09 – 98
NUMBER OF CONTACTS	3
SIZE OF CONTACTS	NO. 20



	15 – 19
	19
	NO. 20

FRONT FACE OF SOCKET INSERT IS SHOWN,
REAR FACE OF SOCKET INSERT IS OPPOSITE

THE VIEW OF THE CONNECTOR IS
MADE LARGER FOR IDENTIFICATION
OF THE CONTACT LOCATIONS

G – 02029 (0000)
PW V

BM5 70 71 12 0 KKM0 00

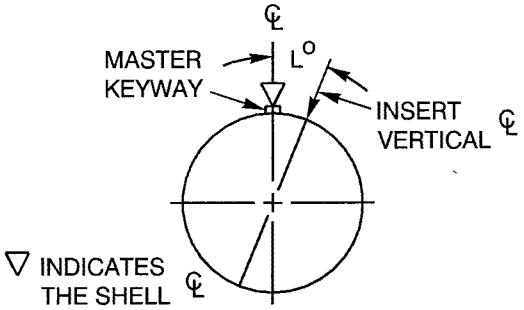
MIL-C-3899 Connector Contact Arrangements
Figure 010

1. IN THE NORMAL POSITION, THE INSERT VERTICAL AND KEY/KEYWAY CENTERLINES ARE THE SAME: $L = 0^{O}$.

2. IN THE ALTERNATE INSERT POSITION (positions W, X, Y AND Z), THE INSERT IS TURNED IN RELATION TO THE CENTERLINE OF THE MASTER KEY OR KEYWAY OF THE SHELL.

   A. IN THE ALTERNATE POSITIONS THE PIN INSERT IS TURNED CLOCKWISE IN THE SHELL AND THE ANGLE A BETWEEN THE INDEX RADIUS AND THE C_L OF THE MASTER KEY OR KEYWAY OF THE SHELL IS AS NECESSARY.

   B. IN THE ALTERNATE POSITIONS THE SOCKET INSERT IS TURNED COUNTERCLOCKWISE IN THE SHELL AND THE ANGLE A BETWEEN THE INDEX RADIUS AND THE C_L OF THE MASTER KEY OR KEYWAY OF THE SHELL IS AS NECESSARY.



PIN INSERT
(Face View)
VIEWED FROM THE ENGAGED END,
SOCKET INSERT OPPOSITE

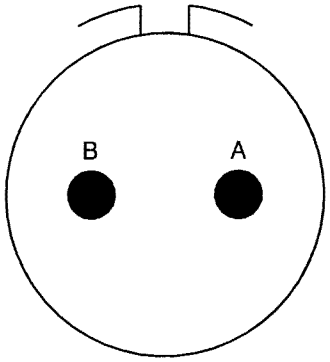
INSERT, CONTACTS AND ALTERNATE KEYING POSITIONS

SHELL SIZE	INSERT ARRANGEMENTS	CONTACTS		ALTERNATE INSERT POSITIONS L DEGREES			
		QTY.	SIZE	W	X	Y	Z
12S	12S–3	2	16	70	145	215	290
14S	14S–7	3	16	90	180	270	–

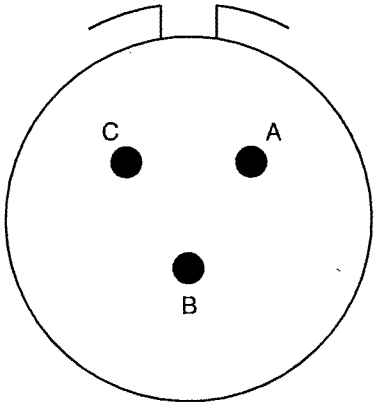
G–02033 (0000)
PW V

BM5 70 71 12 0 KLM0 00

MIL-C-5015 Connectors (Alternate Keying Positions)
Figure 011



CONTACT ARRANGEMENT	12S
NUMBER OF CONTACTS	2
SIZE OF CONTACTS	NO. 16



14S
3
NO. 16

FRONT FACE OF PIN INSERT IS SHOWN,
REAR FACE OF PIN INSERT IS OPPOSITE

THE VIEW OF THE CONNECTOR IS
MADE LARGER FOR IDENTIFICATION
OF THE CONTACT LOCATIONS

G – 02034 (0000)
PW V

BM5 70 71 12 0 KMM0 00

MIL-C-5015 Connector Contact Arrangements
Figure 012

WIRING - HARNESS LACING - DESCRIPTION AND OPERATION

1. Wire Harness Lacing Procedure

A. Reason for the Job

(1)Use this procedure to tie the harness with lacing tape.

B. Equipment and Materials

ITEM	DESIGNATION
(a)Material No.P05-245	Lacing Tape (White) (718Z)
Referenced Procedure - 70-00-00, P. Block 201	Standard Practices - General

C. General

WARNING : DO NOT USE HEAT GUNS, SOLDERING GUNS OR SOLDERING IRONS FOR THE ON-WINGS REPAIRS. THEY ARE NOT RESISTANT TO EXPLOSION AND CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(1)This chapter gives the procedure to tie the harness with lacing tape.
(2)These are the wire harness parts :
  (a)Wire - A single electrical conductor with insulation around it.
  (b)Cable - A group of wires in a metal shield and an insulated jacket.
  (c)Harness - A single cable or two or more cables with connectors or terminal lugs attached to the ends of the cables.
(3)Standard equipment and consumable materials can be replaced with equivalent items.
(4)Lacing tape must be installed on the harness at or near the same locations as before you did the repair.
(5)The distance between the individual laces on the wire bundle is a maximum of 2.00 in. (50.8 mm).
(6)A bundle of two or more cables must be laced together.
(7)A square knot or surgical knot must be used to hold the clove hitch when you tie the lacing tape.
(8)Always obey the specific procedures and limits in the specific AMM maintenance tasks.

D. Lacing Tape

(Ref. Fig. 001)
(Ref. Fig. 002)
(1)Install the lacing tape (Material No.P05-245) on the harness as follows.
(2)Make the cables in the harness group as straight as possible, with a minimum of twists before the lacing is installed.
(3)Do the steps one through eight as shown in the figure.
  (a)Do not use a thermocouple cable (cable jacket is yellow in color) to make the first loop in step one.
(4)The harness must be laced two times at the same position if the diameter of the harness is more than 1.50 in. (38.1 mm). Refer to step nine in the figure.
(5)Cut the two ends of the lacing tape a minimum of 0.25 in. (6.35 mm) to a maximum of 0.50 in. (12.7 mm) from the knot.

E. Bundle Break-out Support Ties

(1)Install the bundle break-out support ties. Use lacing tape (Material No.P05-245).
  NOTE : The support ties must be installed on the harness before and after each bundle break-out. Tie the wire break-outs with a clove hitch and hold clove hitch with a square or surgical knot. All wire bundle break-outs must be in the same plane as the bundle center line and go along the same direction of the break-out.
(2)Make the cables in the harness groups as straight as possible, with a minimum of twists before the lacing is installed.
(3)Make a clove hitch that is loose around the main bundle and branch with lacing tape (Material No.P05-245). Refer to view A.
(4)Put each end across each other and back through the clove hitch and

around the main bundle. Refer to view B.

(5)Make the lacing tape tight.

(6)Hold the lacing tape with a square knot or surgical knot.

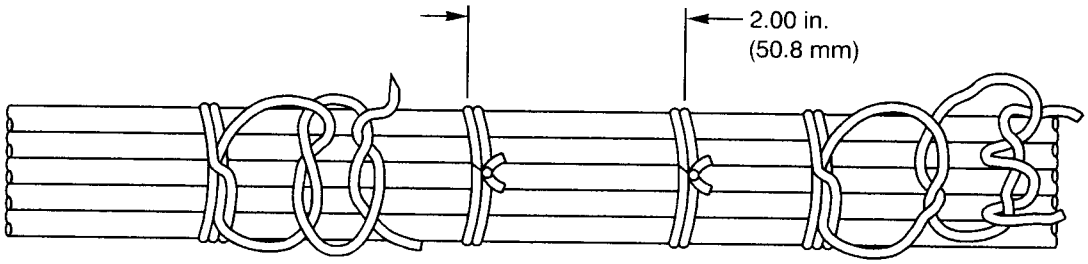
(7)Cut the two ends of the lacing tape ends a minimum of 0.25 in. (6.35 mm) to a maximum of 0.50 in. (12.7 mm) from the knot.

F. Spiral Wrap

(1)Install the spiral wrap if necessary.

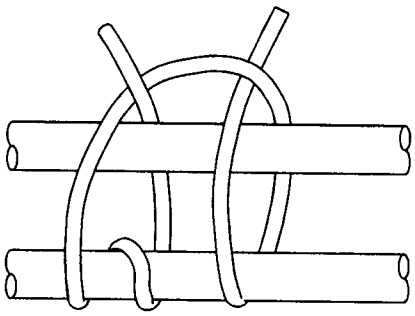
(2)Put a 0.125 in. (3.175 mm) hole in each end of the spiral wrap.

(3)Hold the spiral wrap in position around the bundle with lacing tape (Material No.P05-245). Use a clove hitch and square or surgical knot.

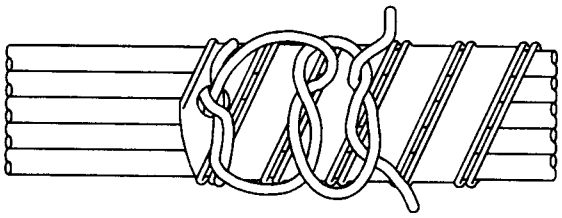


SQUARE KNOT

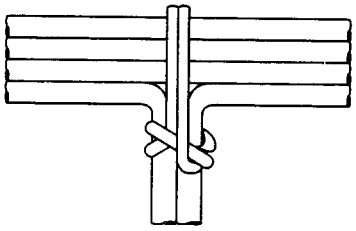
SURGICAL KNOT



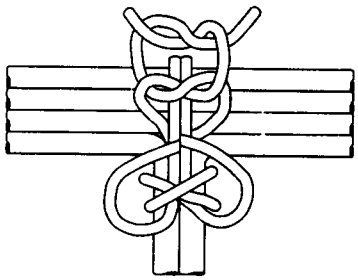
CLOVE HITCH LACING



SPIRAL WRAP



VIEW A

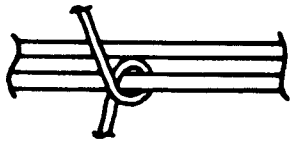


VIEW B

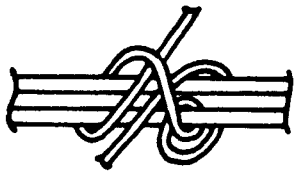
BM5 70 71 14 0 KAM0 00

G – 02043 (0000)
PW V

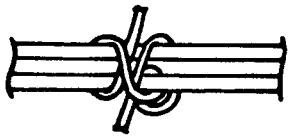
Wire Harness Lacing Procedure
Figure 001



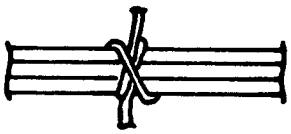
INITIAL LOOP
(DO NOT USE THE
THERMOCOUPLE WIRE)
STEP 1



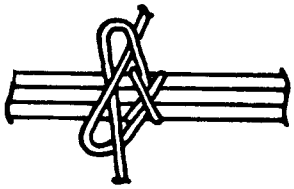
CLOVE HITCH KNOT
(NOT TIGHTENED)
STEP 2



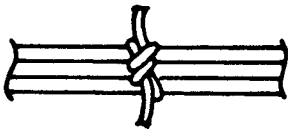
CLOVE HITCH KNOT
(TIGHTENED)
STEP 3



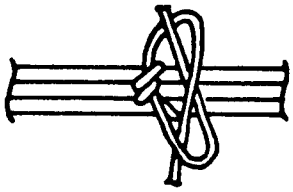
OPPOSITE SIDE OF
THE BUNDLE
STEP 4



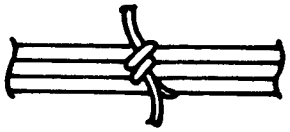
SQUARE KNOT LOOP NO. 1
(NOT TIGHTENED)
STEP 5



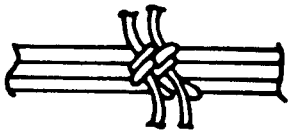
SQUARE KNOT LOOP NO. 1
(TIGHTENED)
STEP 6



SQUARE KNOT LOOP NO. 2
(NOT TIGHTENED)
STEP 7



SQUARE KNOT LOOP NO. 2
(TIGHTENED)
STEP 8



DO THE PROCEDURE AGAIN
FOR BUNDLES MORE THAN
1.500 IN. (38.1 MM) IN DIAMETER
STEP 9

G-02044

BM5 70 71 14 0 KCM0 00

Wire Harness Lacing Procedure
Figure 002

WIRING - CONNECTOR AND BACKSHELL REPLACEMENT - DESCRIPTION AND OPERATION

1. Connector and Backshell Replacement Procedure

A. Reason for the Job

(1)Use this procedure to replace a connector and backshell on an electrical wire harness or cable assembly.

B. Equipment and Materials

ITEM	DESIGNATION
(a)Material No.P03-001	Oils (Ref. 70-00-00)
(b)Material No.P05-248	Special Materials (Ref. 70-00-00)
(c)Material No.P05-287	Special Materials (Ref. 70-00-00)
Referenced Procedures	
- 70-00-00, P. Block 201	Standard Practices - General
- 70-71-12, P. Block 1	Wiring - Connector/Insert Arrangement
- 70-71-14, P. Block 1	Wiring - Harness Lacing
- 70-71-21, P. Block 1	Wiring - Contact Replacement
- 70-71-25, P. Block 1	Wiring - Harness Adapter Plate Replacement
- 71-00-00, P. Block 501	Power Plant - General

C. Standard Tools
(1)Fixtures, Tools, Test and Support Equipment

PART NUMBER	SUPPLIER CODE	NOMENCLATURE	APPLICATION
TG-70	11851 or 06324	Strap Wrench	Used to disconnect and connect electrical connectors.
or			
TG-69	11851 or 06324	Soft Jaw Pliers	Used to disconnect and connect electrical connectors.
CM-S-837	11851	Connector Adapter Kit	Used to remove the backshell (Modified MIL-C-26500, EN2997 and MIL-C-83723 electrical connectors).
CM-S-389T	11851	Connector Adapter Kit	Used to remove the backshell (MIL-C-538999 connector).
CM-S-5015S	11851	Connector Adapter Kit	Used to remove the backshell (MIL-C-5015 connector).
MS27495A16	11851	Insertion Tool 16 Gage	Used to install 16 gage contacts (MIL-C-26500 connector).
MS27495A20	11851	Insertion Tool 20 Gage	Used to install 20 gage contacts (MIL-C-38999 connector).
MS24256R16	11851	Removal Tool 16 Gage	Used to remove 16 gage contacts (MIL-C-26500 connector).
MS27495R20	11851	Removal Tool 20 Gage	Used to remove 20 gage contacts (MIL-C-38999 connector).
M83723/31-16	11851	Insertion/Removal	Used to remove and

	PART NUMBER	SUPPLIER CODE	NOMENCLATURE	APPLICATION
			Tool 16 Gage	install 16 gage contacts (MIL-C-83723 and MIL-C-5015 connectors).
	M83723/31-20	11851	Insertion/Removal Tool 20 Gage	Used to remove and install 20 gage contacts (MIL-C-83723 and MIL-C-5015 connectors).
R	Model 177 (see NOTE 1)	80164	Digital Multimeter (100 ohm scale)	Used to measure continuity.
R	Model 260 (see NOTE 2)	16902	Ohmmeter (100 ohm scale)	Used to measure continuity.
	HT250-4	11851	Retention Test Tool	Used to test the 16 and 20 gage contact retention.
	67-016-01	11851	Replacement Socket Tip	Replacement tip for testing 16 gage contacts with retention test tool.
	68-016-01	11851	Replacement Pin Tip	Replacement tip for testing 16 gage contacts with retention test tool.
	67-020-01	11851	Replacement Socket Tip	Replacement tip for testing 20 gage contacts with retention test tool.
	68-020-01	11851	Replacement Pin Tip	Replacement tip for testing 20 gage contacts with retention test tool.

R NOTE 1 : It is not necessary to use Model 177. An equivalent digital
R multimeter, available by local purchase, is permitted to use.
R NOTE 2 : It is not necessary to use Model 260. An equivalent ohmmeter,
R available by local purchase, is permitted to use.

D. General

WARNING : DO NOT USE HEAT GUNS, SOLDERING GUNS OR SOLDERING IRONS FOR THE ON-WING REPAIRS. THEY ARE NOT RESISTANT TO EXPLOSION AND CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(1)This chapter gives the procedure to replace a connector and backshell on an electrical wire harness or cable assembly.

(2)There are two general types of connector backshells :

(a)Stainless Steel Backshells :

(Ref. Fig. 002)

- These backshells consist of a nut, a body and clamp bars. These backshells ground the braided shields outside the backshell with a hose clamp.

(b)Aluminum Backshells :

(Ref. Fig. 003)

- These backshells consist of a nut, a body, a strain-relief body, and clamp bars. These backshells ground the braided shields inside the backshell.

(3)These are the wire harness parts :

(a)Wire - A single electrical conductor with insulation around it.

(b)Cable - A group of wires in a metal shield and an insulated jacket.

(c)Harness - A single cable or two or more cables with connectors or terminal lugs attached to the ends of the cables.

(4)Refer to the Aircraft Wiring List, Equipment List for the connector Functional Item Number (FIN) and to get the correct part number.

(5)Refer to the Power Plant Illustrated Parts Catalog to identify alternate parts numbers.

(6)Refer to the Aircraft Wiring List, 92-20 Hook-up List for the connector contact-to-contact hook-up and wire color data.

(7)Refer to the connector/insert arrangement (Ref. 70-71-12, P. Block 1) for the connector contact/insert information.

(8)Refer to the wiring - harness lacing (Ref. 70-71-14, P. Block 1) for the harness lacing procedures.

(9)Standard equipment and consumable materials can be replaced with equivalent items.

(10)Always obey the specific procedures and limits in the specific AMM maintenance tasks.

E. Procedure to disconnect the connector

(Ref. Fig. 001)

(1)Use the TG-69 pliers or TG-70 strap wrench to disconnect the applicable electrical connector(s).

(2)If necessary, remove the adapter plate assembly and receptacle from the engine bracket. Refer to the wiring - harness adapter plate replacement procedure (Ref. 70-71-25, P. Block 1).

F. Remove the stainless steel type backshell

(Ref. Fig. 002)

(1)Mark the connector for the correct assembly as follows :

NOTE : The angular or straight position of the backshell is assembled in relation to the master key on the connector. When you install the backshell on the connector you must keep this position.

(a)Make a mark on the connector backshell in relation to the master key located on the front of the connector.
(b)Make a record of the direction and location of the hose clamp screw in relation to the master key located on the front of the connector.
(c)Make a record of the direction and location of the saddle bars and screws located on the strain-relief clamp ears in relation to the master key located on the front of the connector.

(2)If you must replace the backshell, transfer the marks onto the replacement backshell.
(3)Move the hose clamp away from the connector as follows :
NOTE : Make sure you make the position marks before you move the hose clamp.
(a)If necessary, straighten the tab of the hose clamp.
(b)Loosen the hose clamp.
(c)Move the hose clamp over the saddle bars of the strain-relief clamp to the rear of the harness and away from the repair area.
(d)If necessary, remove the hose clamp from the harness.
(4)Remove the screws and saddle bars from the strain-relief clamp ears.
(5)Fold the braided shields rearward under the saddle bars of the strain-relief clamp and along the cable bundle.
(6)Make the braided shields flat and equal.
(7)Remove the rubber tape from the cable jackets located below the strain-relief clamp.
(8)Install the correct size connector adapter in the front of the connector plug assembly.
(a)The CM-S-837 connector adapter kit is used to hold the EN2997, MIL-C-83723 and modified MIL-C-26500 series connector plugs.
(b)The CM-S-389T connector adapter kit is used for the MIL-C-38999 series connector plugs.
(c)The CM-S-5015S connector adapter kit is used for the MIL-C-5015 series connector plugs.
(9)Align the master key of the connector with the master key-way of the adapter.
(10)Disconnect the backshell as follows :
(a)Hold the adapter with a standard wrench or small vice in your hand.
(b)Use the TG-69 pliers or TG-70 strap wrench or a standard wrench to disconnect the backshell.
(11)Carefully move the backshell to the rear of the harness and away from the repair area.
(a)Do not cut, nick or damage the cables, wires or braided shield.

G. Remove the aluminum type backshell
(Ref. Fig. 003)
(1)Mark the connector for the correct assembly as follows :
NOTE : The angular or straight position of the backshell is assembled in relation to the master key on the connector. When you install the backshell on the connector you must keep this position.
(a)Make a mark on the connector backshell in relation to the master key located on the front of the connector.
(b)Make a record of the direction and location of the saddle bars and screws located on the strain-relief clamp ears in relation to the

master key located on the front of the connector.
(2)If you must replace the backshell, transfer the marks onto the replacement backshell.
(3)Cut and remove any lockwire.
(4)Remove the screws and saddle bars from the strain-relief clamp ears.
(5)Fold the braided shields rearward under the saddle bars of the strain-relief clamp and along the cable bundle.
(6)Make the braided shields flat and equal.
(7)Remove the rubber tape from the cable jackets located below the strain-relief clamp.
(8)Install the correct size connector adapter in the front of the connector plug assembly.
(a)The CM-S-837 connector adapter kit is used to hold the EN2997, MIL-C-83723 and modified MIL-C-26500 series connector plugs.
(b)The CM-S-389T connector adapter kit is used for the MIL-C-38999 series connector plugs.
(c)The CM-S-5015S connector adapter kit is used for the MIL-C-5015 series connector plugs.
(9)Align the master key of the connector with the master key-way of the adapter.
(10)Disconnect the backshell as follows :
(a)Hold the adapter with a standard wrench or small vice in your hand.
(b)Use a TG-69 pliers or TG-70 strap wrench to disconnect the strain-relief body from the backshell.
(c)Move the strain-relief body away from the backshell.
(d)Move the conical ring away from the backshell.
(e)Use the TG-69 pliers or TG-70 strap wrench to disconnect the backshell from the connector.
(11)Carefully move the backshell to the rear of the harness and away from the repair area.
(a)Do not cut, nick or damage the cables, wires or braided shield.

H. Remove the contacts from the connector
(Ref. Fig. 004)
(1)If necessary, remove the lacing tape to permit the removal of the contacts.
(2)Remove the contacts from the connector that are necessary to replace the damaged cable as follows :
NOTE : The modified MIL-C-26500 series connectors have contacts that are released from the front of the connector (with the contact removal tool) and then removed from the rear of the connector.
NOTE : All other series connectors have contacts that are released from the rear of the connector and then removed (with the contact removal tool) from the rear of the connector.
NOTE : If you have a contact location that is not used (not used for a circuit), it will contain a contact and sealing plug or a stubwire assembly.
NOTE : If you replace a connector with the stubwire assemblies installed, you must remove all the stubwire assembly contacts (a contact that is crimped on a ten inch wire that is sealed on the opposite end with a cap) for the installation into a new connector.

NOTE : If you replace a connector without the stubwire assemblies installed, you must remove the sealing plugs and contacts that are not used (contacts that do not have a wire attached to them) for the installation into a new connector.

(a)Use the applicable contact removal tool given in the standard equipment for the correct size contact.

(b)Remove the front release contacts as follows :

CAUTION : IF TOO MUCH PRESSURE IS USED WHEN YOU REMOVE THE CONTACTS FROM THE CONNECTOR, DAMAGE TO THE COLLET, CONTACT AND GROMMET CAN OCCUR.

1 Insert the contact removal tool on a contact located in the front face of the connector.

2 Push the contact removal tool into the grommet until it touches the bottom.

NOTE : When the tool touches the bottom of the connector grommet, it will expand the collet from the contact and permit the contact to release from the connector. The tool will start to push the contact and wire out the rear of the connector, but not fully.

3 Remove the contact and wire from the rear of the connector.

4 Remove the tool.

5 Put a label on the wire to identify the contact number.

6 Do this procedure again for the other contacts you will remove.

(c)Remove the rear release contacts as follows :

CAUTION : IF TOO MUCH PRESSURE IS USED WHEN YOU REMOVE THE CONTACTS FROM THE CONNECTOR, DAMAGE TO THE COLLET, CONTACT AND GROMMET CAN OCCUR.

1 Put the contact removal tool on the wire.

2 Move the tool back on the wire while you hold the wire tight.

NOTE : This will permit the wire to go into the slot of the tool.

3 Push the tool along the wire into the rear of the connector grommet until it touches the bottom.

NOTE : When the tool touches the bottom of the connector grommet, it will expand the collet from the contact and permit the contact to release from the connector.

4 Hold the wire against the serrated shoulder of the tool with light hand pressure and remove the wired contact and tool.

5 Remove the tool from the wire.

6 Put a label on the wire to identify the contact number.

7 Do this procedure again for the other contacts you will remove.

(3)If a contact is damaged, replace the contact. Refer to the wiring - contact replacement procedure (Ref. 70-71-21, P. Block 1).

J. Installation of the connector and backshell
(Ref. Fig. 005)

(1)Get the correct replacement connector or backshell.

(a)Refer to the Aircraft Wiring List, Equipment List for the connector Functional Item Number (FIN) to get the correct part number.

(2)For stainless steel type backshells, install the backshell on the harness.

NOTE : Move the backshell rearward over the harness to permit the contacts to be inserted in the connector.

(3)For aluminum type backshells, install the strain-relief body, the conical ring and the backshell on the harness.
NOTE : Move the backshell rearward over the harness to permit the contacts to be inserted in the connector.
(4)Install the contacts on the connector as follows :
NOTE : The backshell must be installed on the harness before you install the contacts on the connector.
(a)Use the applicable contact insertion tool given in the standard equipment for the correct contact size.
(b)Install the insertion tool on the contact.
NOTE : Make sure you install the correct contact in the correct location.
(c)All contacts are installed and locked from the rear of the connector.
(d)Put the contact insertion tool on the wire.
(e)Hold the wire tight and move the tool rearward on the wire.
NOTE : This will permit the wire to go into the slot of the tool.
(f)Push the tool along the wire until the tip of the tool seats on the rear shoulder of the contact.
(g)Install the contact in the connector.
(h)Hold the connector in your hand.
(j)Use the label on the wire to identify the correct contact location.
1 Refer to the Aircraft Wiring List, 92-20 Hook-Up List for detailed wiring data.
(k)Install the insertion tool with the wired contact, contacts that are not used, or stubwire assembly contact into the correct cavity at the rear of the connector with a strong and equal pressure.
CAUTION : **IF TOO MUCH PRESSURE IS USED WHEN YOU INSTALL THE CONTACT INTO THE CONNECTOR, DAMAGE TO THE COLLET, CONTACT AND GROMMET CAN OCCUR.**
(l)Remove the tool.
(m)Lightly pull back on the wire to feel if the contact is locked in the collet.
(n)Do these previous steps until you install all the contacts on the conductors.
(p)Install the larger end of the sealing plugs in the connector grommet of the contacts that are not used.

K. Do a contact retention check
(Ref. Fig. 006)
NOTE : All the contacts must be locked in the connector. This includes all the not used contacts and stubwire assembly contacts.
NOTE : The contact retention force necessary to make sure the contact is locked in the connector is between 10 and 15 lbf. (44.5 and 66.7 N).
(1)Use the correct retention test tool, replacement pin and replacement socket tools that are given in the standard equipment for the correct contact size.
(a)Use the pin replacement tips when you do a test of the socket contacts.
(b)Use the socket replacement tips when you do a test of the pin contacts.
(2)Put the applicable 16 or 20 gage retention test tool and replacement pin or replacement socket on the contact so that they are in a straight line.

CAUTION : BE CAREFUL WHEN YOU DO A CHECK OF THE CONTACTS. INCORRECT USE OF THE RETENTION TEST TOOL COULD RESULT IN DAMAGE TO THE CONNECTORS CONTACT, COLLET, GROMMET AND TEST TOOL.

(3)Keep this position when you do a test on each contact to get the most accurate results.

(4)Apply hand pressure to the tester until the indicator band located on the replacement pin or socket is in line with the body of the tester.

(a)At this point, there is 13 lbf. (57.8 N) of pressure applied.

(b)If the contact is still in position, the contact retention is satisfactory.

(5)Do these previous steps again for all the other contacts that were installed in the connector.

L. Install the stainless steel type backshell on the connector (Ref. Fig. 002)

(1)If necessary, install only the lacing tape (Material No.P05-245) you removed before. Refer to the wire harness lacing (Ref. 70-71-14, P. Block 1) for the harness lacing procedures.

(2)Make the braided shield flat and equal.

(3)Fold the braided shields rearward over the cable jacket.

(4)Keep the braided shields flat and equal.

NOTE : You can temporarily hold the braided shields to the harness with tape, to permit an easier backshell installation.

(5)Hold the connector in your hand and move the backshell over the harness and the braided shields.

(6)Connect the backshell nut to the connector as follows :

CAUTION : DAMAGE TO THE CONNECTOR AND BACKSHELL ANTI-ROTATION TEETH WILL RESULT IF THEY ARE NOT ENGAGED CORRECTLY.

(a)Move the backshell forward over the harness to the connector.

(b)Align the mark you made on the backshell with the master key located on the front face of the connector.

NOTE : The mark you made on the connector backshell will correctly align the connector master key and the backshell when you assemble the backshell to the connector.

(c)Tighten the backshell nut by hand.

(d)Make sure you correctly engage the anti-rotation teeth on the connector with the anti-rotation teeth on the backshell.

(e)Continue to tighten the nut by hand and slightly twist the backshell in a clockwise and counterclockwise direction to engage the anti-rotation teeth.

(f)Make sure the mark on the backshell is aligned with the master key on the connector.

(g)Install the correct size connector adapter in the front of the connector.

NOTE : The connector adapter will hold the connector plug assembly and prevent movement of the connector when you tighten the backshell.

1 The CM-S-837 connector adapter kit is used to hold the EN2997, MIL-C-83723 and modified MIL-C-26500 series connector plugs.

2 The CM-S-389T connector adapter kit is used for the MIL-C-38999 series connector plugs.

3 The CM-S-5015S connector adapter kit is used for the MIL-C-5015 series connector plugs.

(h)Hold the connector plug and adapter in your hand.

(j)Hold the receptacle with a standard wrench or vice in your hand.

NOTE : To install a backshell on a receptacle, you can use a standard wrench or a small vice to hold the flange of the receptacle.

(k)Use the TG-69 pliers or TG-70 strap wrench to tighten the backshell nut on the connector or receptacle until the pliers or strap wrench moves on the nut.

(l)While you hold the connector tight, move the backshell from side to side and in a clockwise and counterclockwise direction.

NOTE : This procedure is to make sure the anti-rotation teeth in the backshell and connector are engaged.

(m)If applicable, look through the inspection hole on the backshell coupling nut to make sure the anti-rotation teeth in the backshell and connector are engaged.

(n)Use the TG-70 strap wrench or crowfoot and TORQUE the backshell nut to between 115 and 125 lbf.in. (1.30 and 1.41 m.daN).

(7)The area of the cables where the outer teflon jacket and braided shields are removed from the conductor wires must be located inside the primary backshell body from 0.250 to 0.500 in. (6.4 to 12.7 mm). This does not include the strain-relief clamp area.

(8)Install the rubber tape (Material No.P05-248) as follows :

(a)If necessary, remove the temporary tape that holds the braided shields to the harness.

(b)Fold the braided shields forward over the backshell.

(c)Wind the rubber tape (Material No.P05-248) around the harness assembly behind the strain-relief clamp ears.

(d)Use a sufficient amount of tape around the harness to hold the harness tight between the saddle bars on the strain-relief clamp.

(e)Hold the cables tight from the rear and carefully push the tape wrap forward to align with the strain-relief clamp saddle bar locations.

(f)Make sure the middle of the tape wrap is aligned under the saddle bar locations of the strain-relief clamp.

(9)Install and tighten the saddle bars on the backshell strain-relief clamp ears as follows :

(a)Fold the braided shields rearward over the tape wrap.

(b)Divide the braided shields into two groups to go under the saddle clamps.

(c)Keep the braided shields flat and equal.

(d)Fold each braided shield forward as follows :
(Ref. Fig. 002)

1 Start the fold on the rear side of the saddle bars from 0.125 to 0.250 in. (3.2 to 6.4 mm).

2 Fold the braided shield forward, flat and even, over the rubber tape, under the strain-relief clamp saddle bars and over the rear edge of the backshell.

3 Each braided shield must not overlap another shield.

(e)Install the saddle bars and screws to the strain-relief clamp ears.

(f)Make sure the position of the saddle bars and screws are in the direction and location that you made a record of when the clamp was

removed.
(g)Tighten the screws on the strain-relief clamp equally to engage the harness and the braided shields in the saddle bars correctly.
(h)Make sure that each braided shield does not overlap another shield.
(j)Continue to tighten the screws until the saddle bars touch the ears of the strain-relief clamp.
Do not TORQUE more than 20 lbf.in. (2.260 m.daN).
(k)The harness must not move in the clamp.
(l)If the harness is not tight in the clamp, add more rubber tape (Material No.P05-248) around the harness.
(m)If the saddle bar surfaces do not touch the ears of the backshell strain-relief clamp, remove some of the rubber tape (Material No.P05-248) wrap.
(n)No tape wrap or braided shield is permitted between the strain-relief clamp ears and the saddle bars.
(p)TORQUE the clamp screws to 20 lbf.in. (0.23 m.daN).
(10)Install the braided shields and hose clamp on the backshell as follows :
(a)Make sure the braided shields are folded forward, flat and equal, over the top of the backshell.
(b)Cut the ends of each braided shield to a length between 0.250 to 0.500 in. (6.4 to 12.7 mm) forward of the front rib of the backshell.
(c)Fold each braided shield as follows :
1 Make the braided shield flat and equal.
2 Fold each braided shield downward and back under the shield.
3 Make sure each shield is flat and equal and the shields are aligned in the rear groove of the backshell.
NOTE : These shields must be flat and align under the hose clamp.
NOTE : Each shield must not overlap another shield.
(d)Move the hose clamp forward or install the clamp in the rear grooves of the backshell over the braided shields.
NOTE : This will ground the braided shields to the backshell.
(e)Put the hose clamp screw in the direction and location that you made a record of when the clamp was removed.
(f)Do not put the clamp screw over the braided shields.
(g)Carefully align each braided shield under the hose clamp.
(h)Each shield must not overlap another shield.
(j)Make sure the forward edge of each folded braided shield is positioned to extend on the front side of the hose clamp.
(k)Tighten the hose clamp screw.
(11)Bend the end of the hose clamp down sufficiently to touch the piece of the hose clamp that goes around the backshell.

M. Install the aluminum type backshell on the connector
(Ref. Fig. 003)
(1)If necessary, install only the lacing tape (Material No.P05-245) you removed before. Refer to the wire harness lacing (Ref. 70-71-14, P. Block 1) for the harness lacing procedures.
(2)Make the braided shield flat and equal.
(3)Fold the braided shields rearward over the cable jacket.
(4)Keep the braided shields flat and equal.
NOTE : You can temporarily hold the braided shields to the harness with

tape, to permit an easier backshell installation.

(5)Hold the connector in your hand and move the backshell over the harness and the braided shields.

(6)Connect the backshell nut to the connector as follows :

CAUTION : DAMAGE TO THE CONNECTOR AND BACKSHELL ANTI-ROTATION TEETH WILL RESULT IF THEY ARE NOT ENGAGED CORRECTLY.

(a)Move the backshell forward over the harness to the connector.

(b)Align the mark you made on the backshell with the master key located on the front face of the connector.

NOTE : The mark you made on the connector backshell will correctly align the connector master key and the backshell when you assemble the backshell to the connector.

(c)Tighten the backshell nut by hand.

(d)Make sure you correctly engage the anti-rotation teeth on the connector with the anti-rotation teeth on the backshell.

(e)Continue to tighten the nut by hand and slightly twist the backshell in a clockwise and counterclockwise direction to engage the anti-rotation teeth.

(f)Make sure the mark on the backshell is aligned with the master key on the connector.

(g)Install the correct size connector adapter in the front of the connector.

NOTE : The connector adapter will hold the connector plug assembly and prevent movement of the connector when you tighten the backshell.

1 The CM-S-837 connector adapter kit is used to hold the EN2997, MIL-C-83723 and modified MIL-C-26500 series connector plugs.

2 The CM-S-389T connector adapter kit is used for the MIL-C-38999 series connector plugs.

3 The CM-S-5015S connector adapter kit is used for the MIL-C-5015 series connector plugs.

(h)Hold the connector plug and adapter in your hand.

(j)Use the TG-69 pliers or TG-70 strap wrench to tighten the backshell nut to the connector until the pliers or strap wrench moves on the nut and until the metal surface of the coupling nut touches the metal surface of the connector.

(k)While you hold the connector tight, move the backshell from side to side and in a clockwise and counterclockwise direction.

NOTE : This procedure is to make sure the anti-rotation teeth in the backshell and connector are engaged.

(7)The area of the cables where the outer teflon jacket and braided shields are removed from the conductor wires must be located inside the primary backshell body from 0.250 to 0.500 in. (6.4 to 12.7 mm). This does not include the strain-relief clamp area.

(8)Install the strain-relief body as follows :

(a)Put the braided shields equally around the conical seat of the backshell.

(b)Move the conical ring over the harness.

(c)Put the conical ring into the back of the backshell with the braided shields located between the backshell and the ring.

(d)Push the conical ring into the backshell.

(e)Move the strain-relief body over the harness and braided shields.
(f)Connect the strain-relief body nut to the backshell handtight only.
(g)Use the TG-69 pliers or TG-70 strap wrench to tighten the strain-relief body nut to the connector until the pliers or strap wrench moves on the nut.

(9)Install the rubber tape (Material No.P05-248) as follows :
(a)If necessary, remove the temporary tape that holds the braided shields to the harness.
(b)Fold the braided shields forward over the backshell.
(c)Wind the rubber tape (Material No.P05-248) around the harness assembly behind the strain-relief clamp ears.
(d)Use a sufficient amount of tape around the harness to hold the harness tight between the saddle bars on the strain-relief clamp.
(e)Hold the cables tight from the rear and carefully push the tape wrap forward to align with the strain-relief clamp saddle bar locations.
(f)Make sure the middle of the tape wrap is aligned under the saddle bar locations of the strain-relief clamp.

(10)Install and tighten the saddle bars on the backshell strain-relief clamp ears as follows :
(a)Fold the braided shields rearward over the tape wrap.
(b)Divide the braided shields into two groups to go under each saddle bar.
(c)Fold each braided shield forward as follows :
1 Fold the braided shield forward and even, over the rubber tape, under the saddle bar locations again.
2 Each braided shield must not overlap another shield.
3 Keep the braided shields flat and equal.
(d)Install the saddle bars and screws on the strain-relief clamp ears over the tape and braided shields.
(e)Make sure the position of the saddle bars and screws are in the direction and location that you made a record of when the clamp was removed.
(f)Tighten the screws on the strain-relief clamp equally to engage the harness and the braided shields in the saddle bars correctly.
(g)Make sure that each braided shield does not overlap another shield.
(h)Continue to tighten the screws until the saddle bars touch the ears of the strain-relief clamp.
Do not TORQUE more than 20 lbf.in. (0.23 m.daN).
(j)The harness must not move in the clamp.
(k)If the harness is not tight in the clamp, add more rubber tape (Material No.P05-248) around the harness.
(l)If the saddle bar surfaces do not touch the ears of the backshell strain-relief clamp, remove some of the rubber tape (Material No.P05-248) wrap.
(m)No tape wrap or braided shield is permitted between the strain-relief clamp ears and the saddle bars.
(n)TORQUE the clamp screws to 20 lbf.in. (0.23 m.daN).

(11)Safety the strain-relief body and backshell with lockwire (Material No.P05-287).

N. Do the electrical checks
CAUTION : DO NOT BEND OR PUT STRESS ON THE CONTACTS WHEN YOU DO THE TEST.

DAMAGE TO THE CONNECTOR OR CONTACT CAN OCCUR.

(1)Use the TG-69 pliers or the TG-70 strap wrench to disconnect the wire harness connectors which attach to the ends of the circuits that you will do a test of.

(2)Do the wire continuity check as follows :

(a)Do a wire continuity check on all the contacts from point-to-point (from one end of the wire to the other end of the wire).

R (b)Use a digital multimeter or ohmmeter.

(c)Measure the resistance on all circuits.

(d)Each circuit must have continuity from one end of the wire to the other end of the wire.

NOTE : Refer to the Aircraft Wiring List, 92-20 Hook-up List for detailed pin-to-pin and wire color data.

(3)Do the insulation resistance check as follows :

WARNING : DO NOT USE A MEGOHMMETER FOR THE INSULATION RESISTANCE TEST OF THE ON-WING WIRE REPAIR. THIS COULD RESULT IN INJURY TO PERSONS OR DAMAGE TO THE AIRPLANE.

CAUTION : YOU MUST DISCONNECT ALL THE CONNECTORS ON THE CIRCUIT WHICH YOU WILL CHECK. IF YOU DO NOT DO THIS, IT CAN CAUSE UNSATISFACTORY RESISTANCE INDICATIONS AND POSSIBLE DAMAGE TO THE CIRCUITS.

CAUTION : DO NOT BEND OR PUT STRESS ON THE CONTACTS WHEN YOU DO THE TEST. DAMAGE TO THE CONNECTOR OR CONTACT CAN OCCUR.

R (a)Use a digital multimeter or ohmmeter.

(b)Set the ohmmeter to the 100K ohm scale.

(c)Attach the ohmmeter test leads for insulation resistance check (wire to wire) as follows :

1 Attach one ohmmeter test lead to one contact.

2 Connect the other lead to the other contacts, one at a time, which do not connect to the same circuit.

3 Measure the insulation resistance.

4 The resistance must be a minimum of 100K ohms.

5 Do the procedure again for all the other wires you will do a test of.

(d)Attach the ohmmeter test leads for insulation resistance check (wire to ground) as follows :

1 Attach one ohmmeter test lead to the backshell.

2 Connect the other lead to all contacts, one at a time.

3 Measure the insulation resistance.

4 The resistance must be a minimum of 100K ohms.

5 Do the procedure again for all the other wires you will do a test of.

(e)Remove the ohmmeter leads.

P. Connect the connectors
(Ref. Fig. 001)

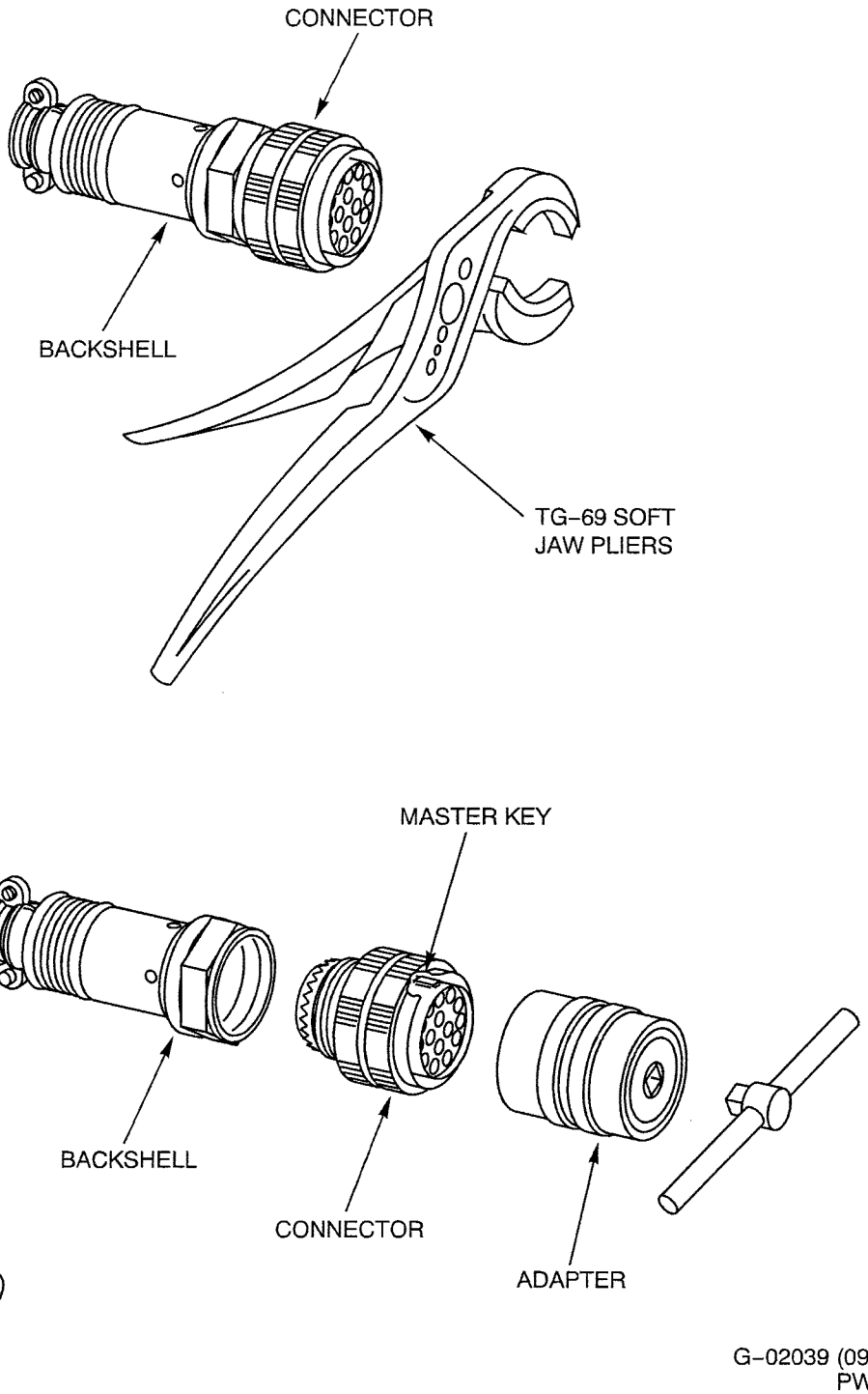
(1)If necessary, install the connector receptacle in the adapter plate assembly as follows :

(a)Align the master key-way on the receptacle with the mark you made on the adapter plate.

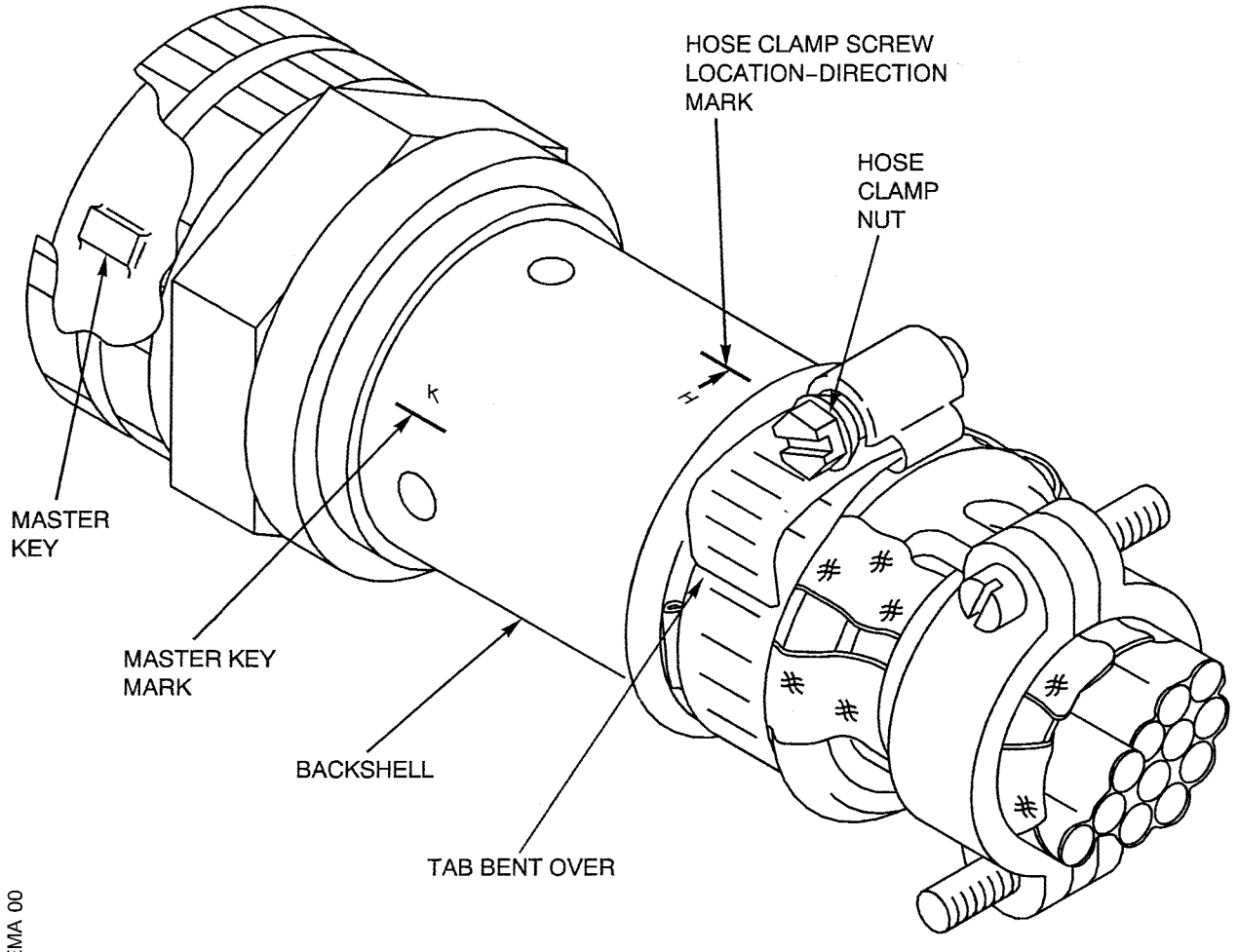
(b)Install the receptacle in the adapter plate.

(c)Install the screws through the adapter plate and receptacle.
(d)Attach the nuts to the screws and tighten.
(e)Torque the nuts as follows :
1 TORQUE the No. 4-40 nuts to a maximum of 5 lbf.in. (0.056 m.daN).
2 TORQUE the No. 6-32 nuts to a maximum of 10 lbf.in. (0.112 m.daN).
(f)Apply engine oil (Material No.P03-001) to the bolts.
(g)Install the adapter plate on the engine bracket.
(h)Install and tighten the bolts.
(j)TORQUE the bolts to between 36 and 40 lbf.in. (0.41 and 0.45 m.daN).
(2)Connect the self-locking electrical connector as follows and in the correct sequence as shown below :
CAUTION : USE THE CORRECT ASSEMBLY PROCEDURE AND TOOLS WHEN YOU INSTALL THE HARNESS CONNECTOR. IF YOU DO NOT, THE CONNECTOR CAN BECOME LOOSE OR DAMAGED. A LOOSE CONNECTOR CAN CAUSE THE ENGINE TO OPERATE INCORRECTLY WITH THE RISK OF AN IN FLIGHT SHUTDOWN.
CAUTION : DO NOT USE A METAL JAWED TOOL TO TIGHTEN THE CONNECTOR. THIS WILL CAUSE DAMAGE TO THE CONNECTOR.
(a)Examine, align the keyway and engage the connector.
(b)Push lightly inward on the connector while tightening the coupling ring.
(c)Use the soft jaw pliers or the strap wrench and tighten the connector against the receptacle.
(d)While you tighten, push the connector in and from side to side.
(e)Make sure you can feel the ratchet feature.
(f)Tighten the connector until the pliers or strap wrench slip on the connector ring.
(3)Connect the non-self-locking electrical connector as follows and in the correct sequence as shown below :
CAUTION : USE THE CORRECT ASSEMBLY PROCEDURE AND TOOLS WHEN YOU INSTALL THE HARNESS CONNECTOR. IF YOU DO NOT, THE CONNECTOR CAN BECOME LOOSE OR DAMAGED. A LOOSE CONNECTOR CAN CAUSE THE ENGINE TO OPERATE INCORRECTLY WITH THE RISK OF AN IN FLIGHT SHUTDOWN.
CAUTION : DO NOT USE A METAL JAWED TOOL TO TIGHTEN THE CONNECTOR. THIS WILL CAUSE DAMAGE TO THE CONNECTOR.
(a)Examine, align the keyway and engage the connector.
(b)Push lightly inward on the connector while tightening the coupling ring.
(c)Use the soft jaw pliers or the strap wrench and tighten the connector against the receptacle.
(d)While you tighten, push the connector in and from side to side.
(e)Tighten the connector until the pliers or strap wrench slip on the connector ring.
(f)Safety the connector with lockwire (Material No. P05-287).

Q. Test the engine
(1)Test the engine. Refer to the specific AMM Test Reference Table, Test Requirements After Engine/Module/Component Repairs or Replacement (Ref. 71-00-00, P. Block 501).



Connector and Backshell Replacement Procedure
Figure 001



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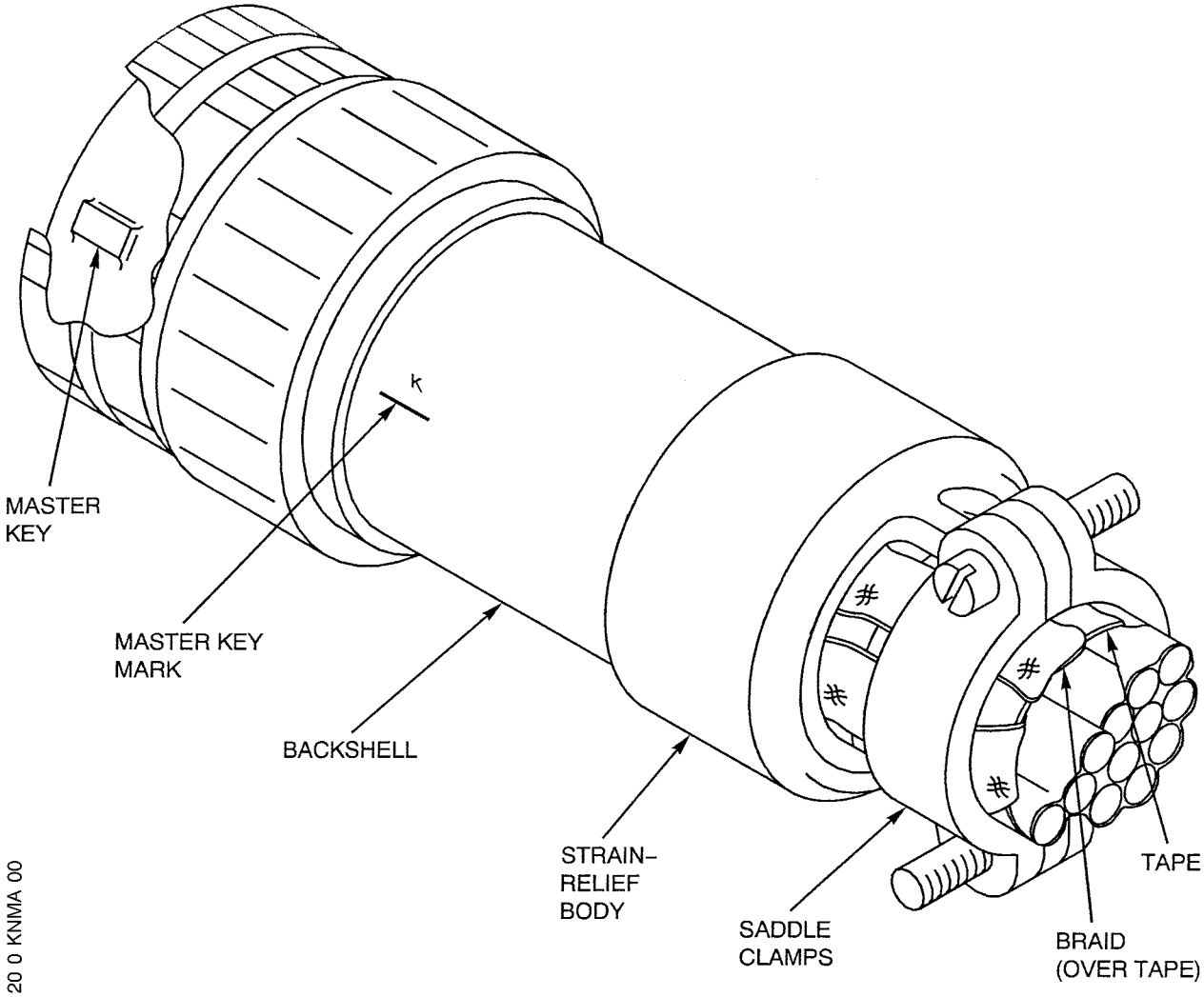
PW V

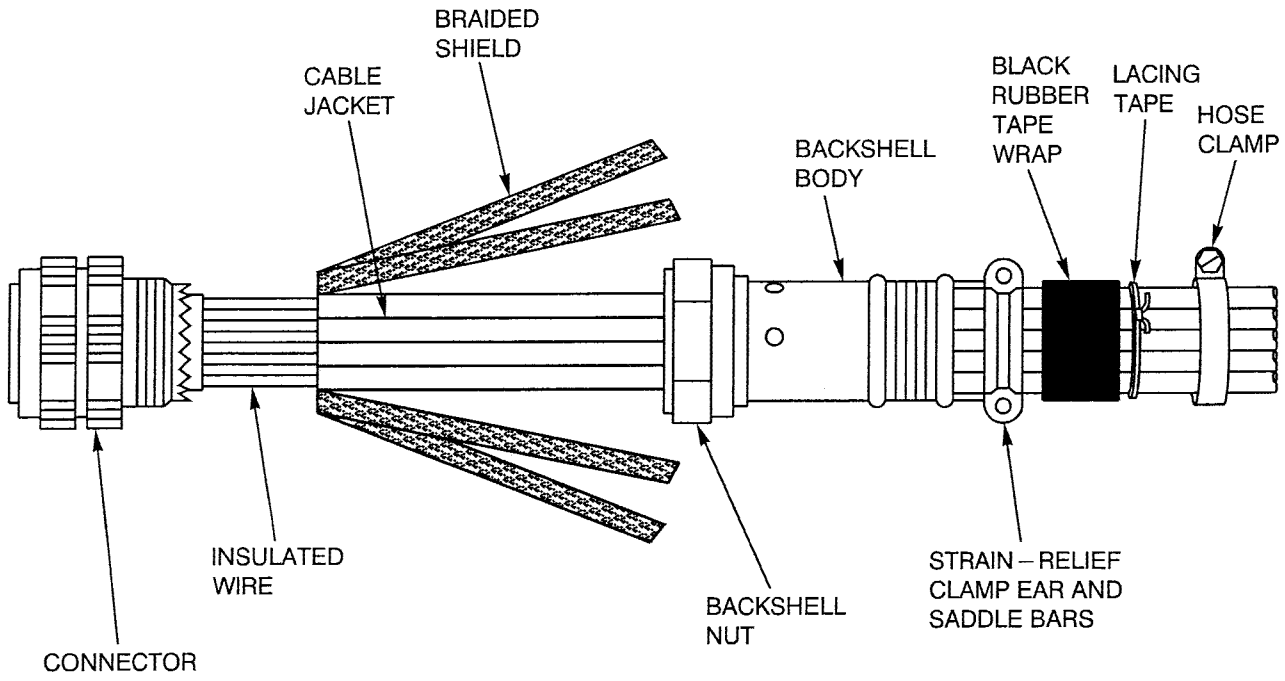
Connector and Backshell Replacement Procedure
- (Stainless Steel Backshell) - Sheet 1/3
Figure 002

R



Connector and Backshell Replacement Procedure
- (Aluminum Backshell Type) - Sheet 1/3
Figure 003

R

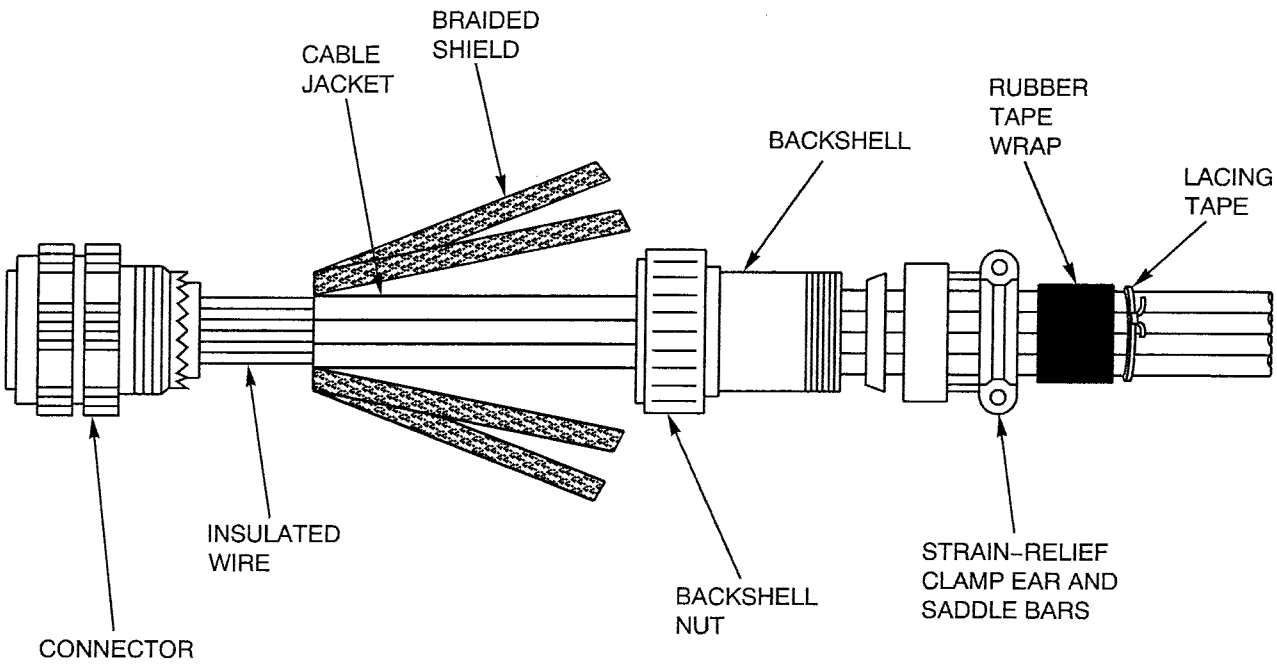


BM5 70 71 20 0 KEMJ 00

G – 02040 (0000)
PW V

Connector and Backshell Replacement Procedure
- (Stainless Steel Backshell Type) - Sheet 2/3
Figure 002

R



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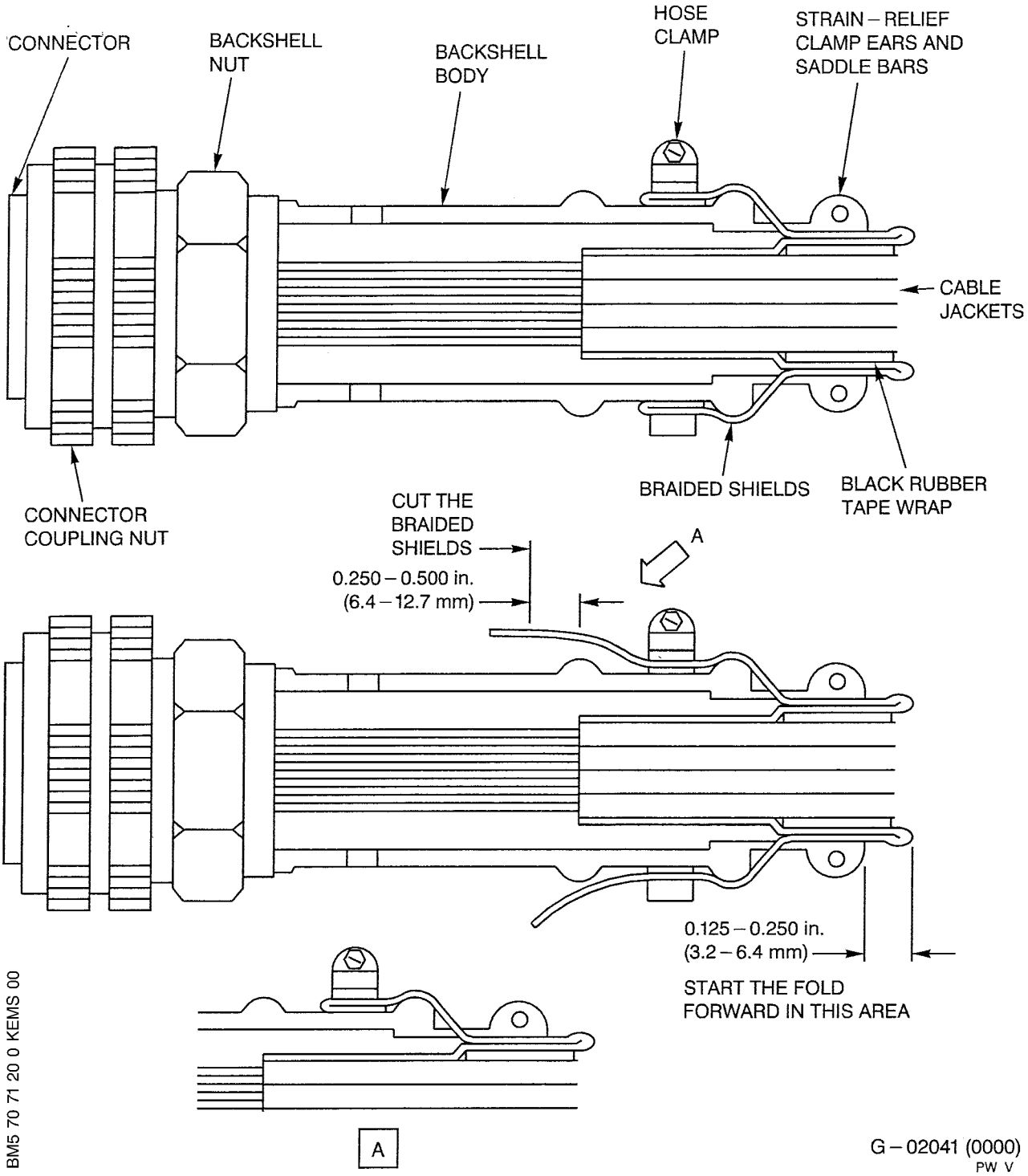
PW V

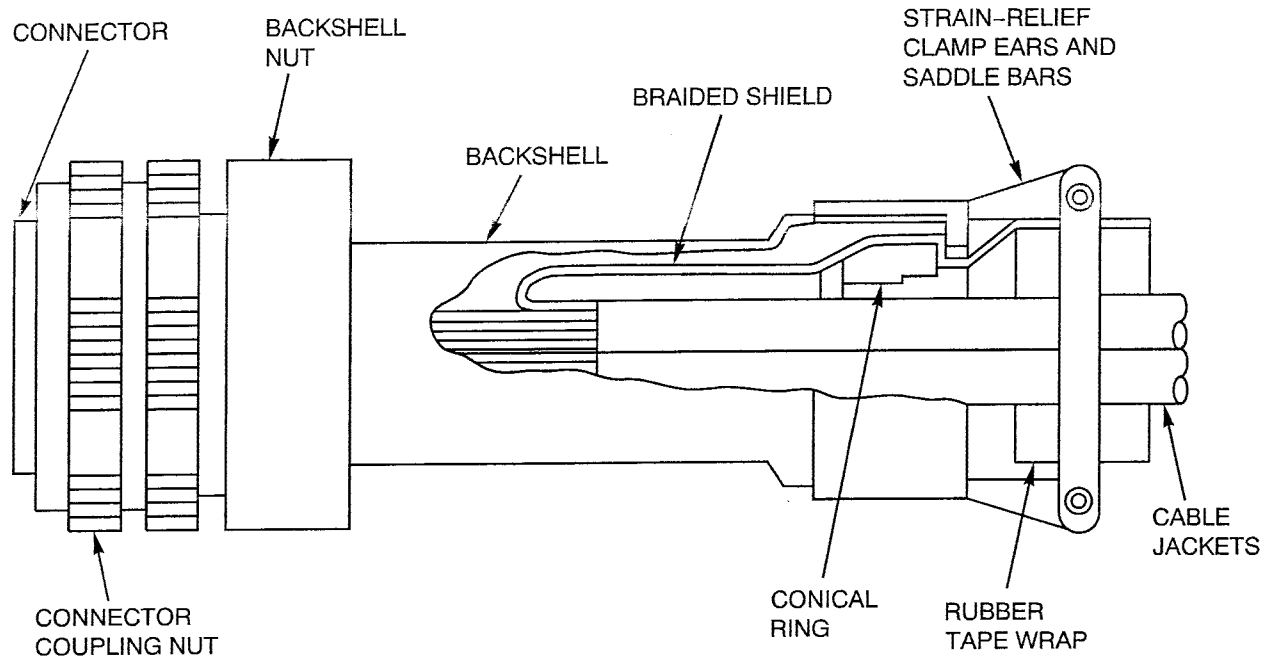
Connector and Backshell Replacement Procedure
- (Aluminum Backshell Type) - Sheet 2/3
Figure 003

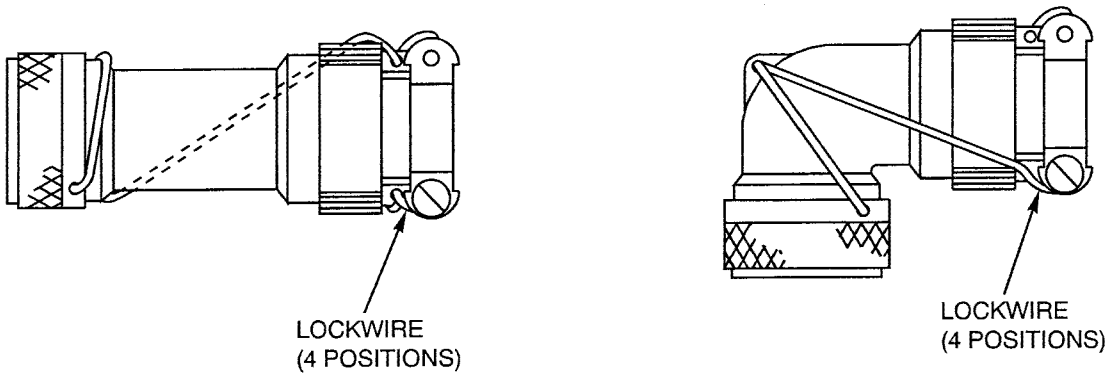
R



Connector and Backshell Replacement Procedure
- (Stainless Steel Backshell Type) - Sheet 3/3
Figure 002

R





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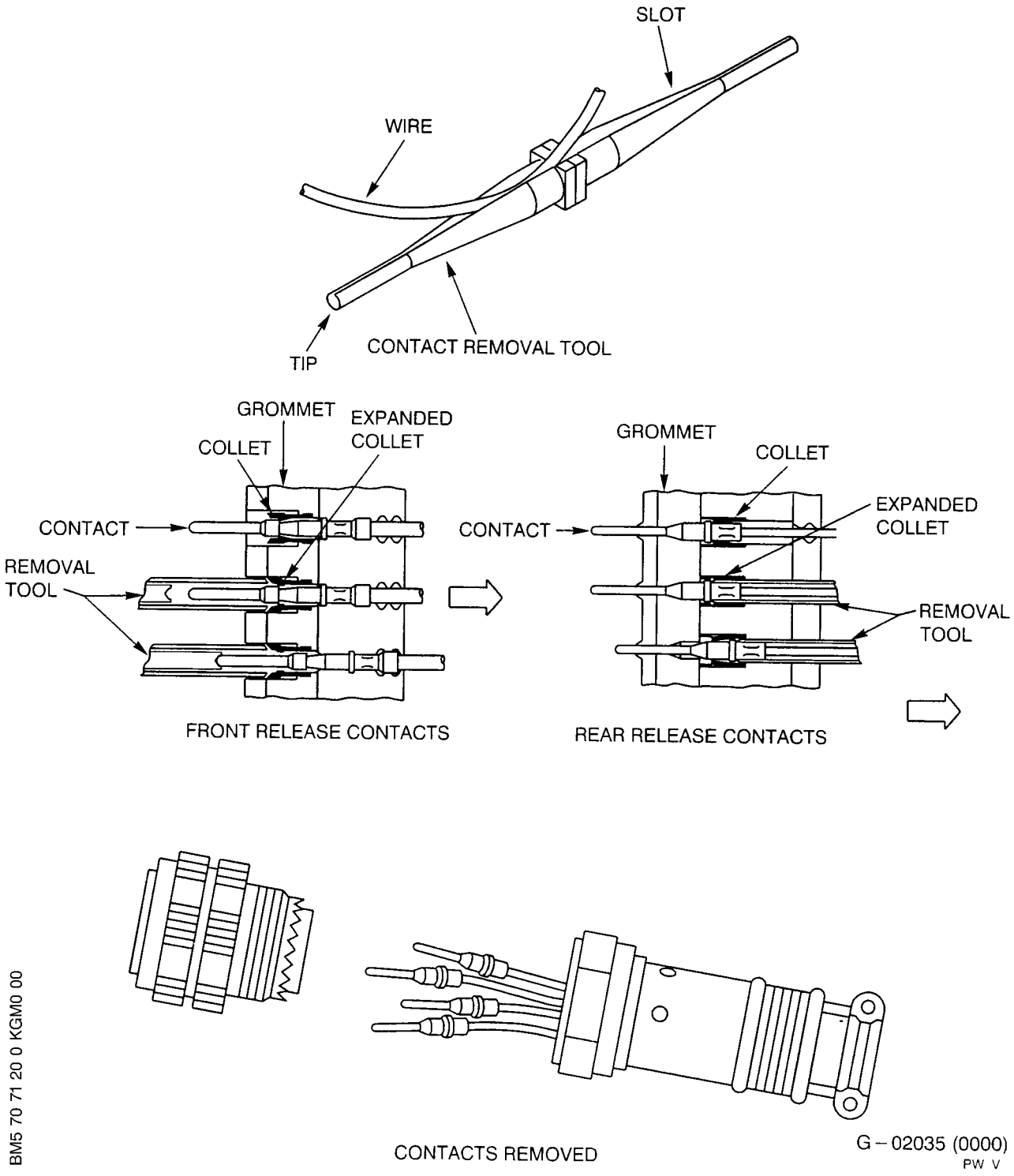
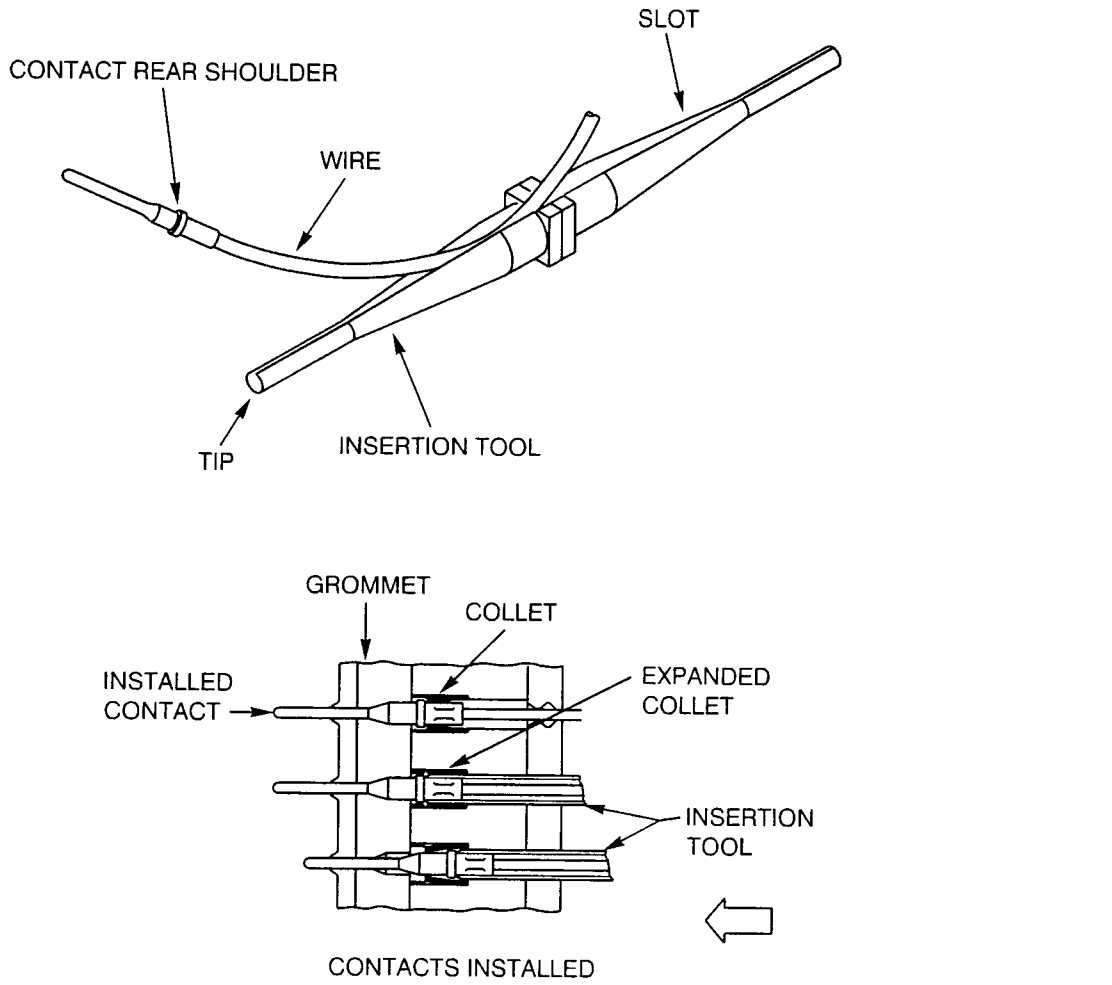
PW V

Connector and Backshell Replacement Procedure
- (Aluminum Backshell Type) - Sheet 3/3
Figure 003

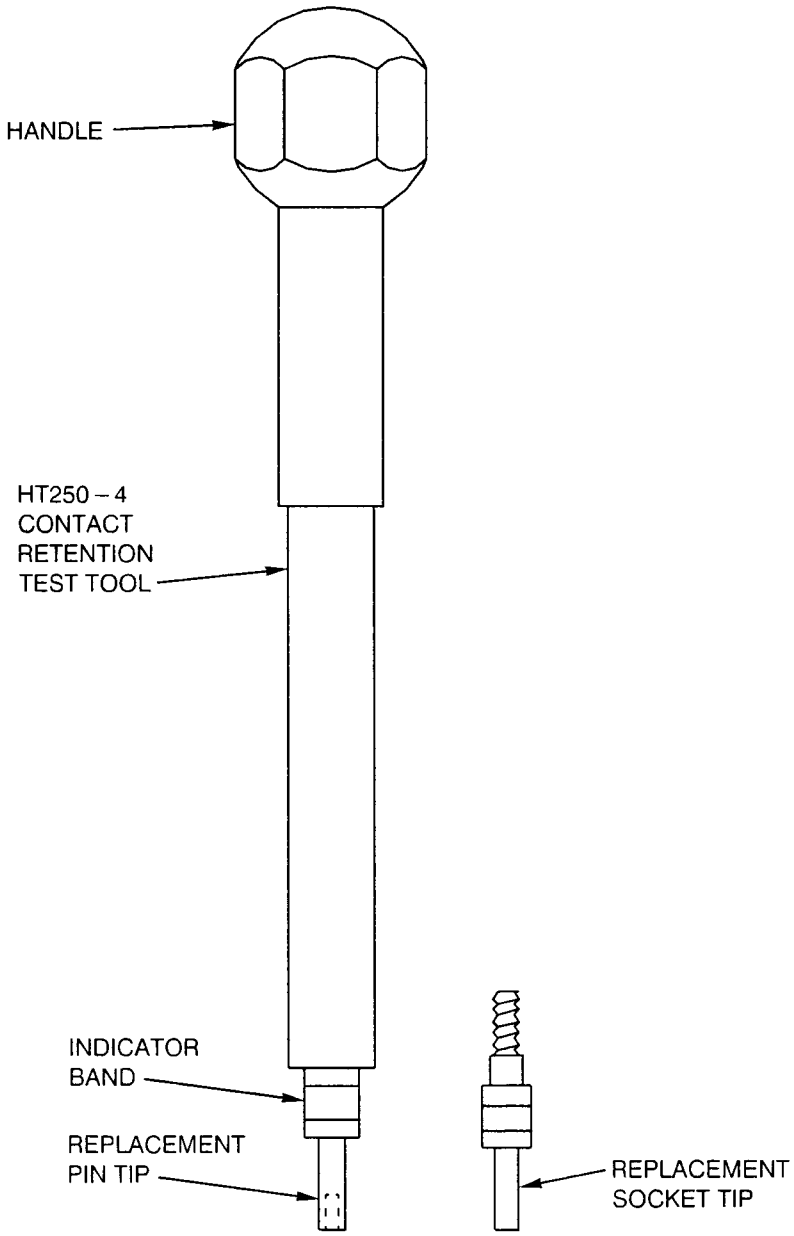
R



Connector and Backshell Replacement Procedure
Figure 004



Connector and Backshell Replacement Procedure
Figure 005



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G – 02042 (0000)
PW V

Connector and Backshell Replacement Procedure
Figure 006

WIRING - CONTACT REPLACEMENT - DESCRIPTION AND OPERATION

1. Contact Replacement Procedure

A. Reason for the Job

(1)Use this procedure to replace a connector contact (pin or socket) on an electrical wire harness or cable assembly.

B. Equipment and Materials

ITEM	DESIGNATION
(1)Material No.P05-245	Special Materials (Ref. 70-00-00)
Referenced Procedures	
- 70-00-00, P. Block 201	Standard Practices - General
- 70-71-12, P. Block 1	Wiring - Connector/Insert Arrangement
- 70-71-14, P. Block 1	Wiring - Harness Lacing
- 70-71-20, P. Block 1	Wiring - Connector and Backshell Replacement
- 70-71-25, P. Block 1	Wiring - Harness Adapter Plate Replacement
- 71-00-00, P. Block 501	Power Plant - General

C. Standard Tools

(1)Fixtures, Tools, Test and Support Equipment

PART NUMBER	SUPPLIER CODE	NOMENCLATURE	APPLICATION
TG-70	11851 or 06324	Strap Wrench	Used to disconnect and connect electrical connectors.
or			
TG-69	11851 or 06324	Soft Jaw Pliers	Used to disconnect and connect electrical connectors.
MS27495A16	11851	Insertion Tool 16 Gage	Used to install 16 gage contacts. (MIL-C-26500 Connector)
MS27495A20	11851	Insertion Tool 20 Gage	Used to install 20 gage contacts. (MIL-C-38999 Connector)
MS24256R16	11851	Removal Tool 16 Gage	Used to remove 16 gage contacts. (MIL-C-26500 Connector)
MS27495R20	11851	Removal Tool	Used to remove

	PART NUMBER	SUPPLIER CODE	NOMENCLATURE	APPLICATION
			20 Gage	20 gage contacts. (MIL-C-38999 Connector)
	M83723/31-16	11851	Insertion/Removal Tool 16 Gage	Used to remove and install 16 gage contacts. (MIL-C-83723 and MIL-C-5015 Connectors)
	M83723/31-20	11851	Insertion/Removal Tool 20 Gage	Used to remove and install 20 gage contacts. (MIL-C-83723 and MIL-C-5015 Connectors)
R	Model 177 (see NOTE 1)	80164	Digital Multimeter (100 ohm scale)	Used to measure continuity.
R	Model 260 (see NOTE 2)	16902	Ohmmeter (100 ohm scale)	Used to measure continuity.
	HT250-4	11851	Retention Test Tool	Used to test the 16 and 20 gage contact retention.
	67-016-01	11851	Replacement Socket Tip	Replacement tip for testing 16 gage contacts with retention test tool.
	68-016-01	11851	Replacement Pin Tip	Replacement tip for testing 16 gage contacts with retention test tool.
	67-020-01	11851	Replacement Socket Tip	Replacement tip for testing 20 gage contacts with retention test tool.
	68-020-01	11851	Replacement Pin Tip	Replacement tip for testing 20 gage contacts with retention test tool.
	Strip Master No. 45-092	11851	Wire Stripper	Used to strip the wire for contact

PART NUMBER	SUPPLIER CODE	NOMENCLATURE	APPLICATION
			replacement.
M22520/7-01	11851	Crimp Tool Frame	Used to crimp the contact on the wire.
M22520/7-03	11851	Crimp Tool Positioner, 16 gage	Used with the crimp tool frame to crimp all the 16 gage contacts on the wire.
M22520/7-02	11851	Crimp Tool Positioner, 20 gage	Used with the crimp tool frame to crimp all the 20 gage contacts on the wire. This does not include MIL-C-38999 contacts.
M22520/7-08	11851	Crimp Tool Positioner, 20 gage	Used with the crimp tool frame to crimp the 20 gage MIL-C-38999 contacts on the wire.

R NOTE 1 : It is not necessary to use Model 177. An equivalent digital
R multimeter, available by local purchase, is permitted to use.
R NOTE 2 : It is not necessary to use Model 260. An equivalent ohmmeter,
R available by local purchase, is permitted to use.

D. General

WARNING : DO NOT USE HEAT GUNS, SOLDERING GUNS OR SOLDERING IRONS FOR THE ON-WING REPAIRS. THEY ARE NOT RESISTANT TO EXPLOSION AND CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(1)This chapter gives the procedure to replace a connector contact (pin or socket) on an electrical wire harness or cable assembly.

(2)These are the wire harness parts :

(a)Wire - A single electrical conductor with insulation around it.

(b)Cable - A group of wires in a metal shield and an insulated jacket.

(c)Harness - A single cable or two or more cables with connectors or terminal lugs attached to the ends of the cables.

(3)You can replace the individual contacts two times in a shielded cable before you must replace the shielded cable.

(4)Replace the shielded cable if you replaced the contacts more than two times. Refer to the Shielded Wire Replacement Procedure (Ref. 70-71-24, P. Block 1).

(5)Refer to the Aircraft Wiring List, Equipment List for the connector Function Identification Number (FIN) and to get the correct part number.

(6)Refer to the Power Plant Illustrated Parts Catalog to identify alternate part numbers.
(7)Refer to the Aircraft Wiring List, 92-20 Hook-Up List for the connector contact-to-contact hook-up and wire color data.
(8)Refer to the Connector Insert Arrangement (Ref. 70-71-12, P. Block 1) for the connector contact/insert information.
(9)Refer to the Wire Harness Lacing Procedure (Ref. 70-71-14, P. Block 1) for the harness lacing procedures.
(10)Standard equipment and consumable materials can be replaced with equivalent items.
(11)Always obey the specific procedures and limits in the specific AMM maintenance tasks.

E. Procedure - Remove the backshell
(1)Use the TG-69 Pliers or TG-70 strap wrench to disconnect the applicable electrical connector(s).
(2)If necessary, remove the adapter plate assembly and receptacle from the engine bracket. Refer to the Adapter Plate Replacement Procedure (Ref. 70-71-25, P. Block 1).
(3)Remove the applicable connector and backshell. Refer to the Connector and Backshell Replacement Procedure (Ref. 70-71-20, P. Block 1).

F. Remove the contacts from the connector
(Ref. Fig. 001, 002, 003)
(Ref. Fig. 004)
(1)If necessary, remove the lacing tape to permit the removal of the contacts.
(2)Remove the contacts from the connector that are necessary to replace the damaged cable as follows :
NOTE : The modified MIL-C-26500 series connectors have contacts that are released from the front of the connector (with the Contact Removal Tool) and then removed from the rear of the connector.
NOTE : All other series connectors have contacts that are released from the rear of the connector and then removed (with the Contact Removal Tool) from the rear of the connector.
NOTE : If you have a contact location that is not used (not used for a circuit), it will contain a contact and sealing plug or a stubwire assembly.
NOTE : If you replace a connector with the stubwire assemblies installed, you must remove all the stubwire assembly contacts (a contact that is crimped on a ten inch wire that is sealed on the opposite end with a cap) for the installation into a new connector.
NOTE : If you replace a connector without the stubwire assemblies installed, you must remove the sealing plugs and contacts that are not used (contacts that do not have a wire attached to them) for the installation into a new connector.
(a)Use the applicable contact removal tool given in the standard equipment for the correct size contact.
(b)Remove the front release contacts as follows :
CAUTION : IF TOO MUCH PRESSURE IS USED WHEN YOU REMOVE THE CONTACTS FROM THE CONNECTOR, DAMAGE TO THE COLLET, CONTACT AND GROMMET

CAN OCCUR.

1 Insert the contact removal tool on a contact located in the front face of the connector.

2 Push the contact removal tool into the grommet until it touches the bottom.

NOTE : When the tool touches the bottom of the connector grommet, it will expand the collet from the contact and permit the contact to release from the connector. The tool will start to push the contact and wire out the rear of the connector, but not fully.

3 Remove the contact and wire from the rear of the connector.

4 Remove the tool.

5 Put a label on the wire to identify the contact number.

6 Do this procedure again for the other contacts you will remove.

(c)Remove the rear release contacts as follows :

CAUTION : IF TOO MUCH PRESSURE IS USED WHEN YOU REMOVE THE CONTACTS FROM THE CONNECTOR, DAMAGE TO THE COLLET, CONTACT AND GROMMET CAN OCCUR.

1 Put the contact removal tool on the wire.

2 Move the tool back on the wire while you hold the wire tight.

NOTE : This will permit the wire to go into the slot of the tool.

3 Push the tool along the wire into the rear of the connector grommet until it touches the bottom.

NOTE : When the tool touches the bottom of the connector grommet, it will expand the collet from the contact and permit the contact to release from the connector.

4 Hold the wire against the serrated shoulder of the tool with light hand pressure and remove the wired contact and tool.

5 Remove the tool from the wire.

6 Put a label on the wire to identify the contact number.

7 Do this procedure again for the other contacts you will remove.

G. Preparation for installation of the contact

(1)Cut the damaged conductor in the middle of the crimp on the contact barrel as shown in the figure.

NOTE : The individual contacts on a cable can be replaced two times. There is a minimum of 0.250 in. (6.35 mm) spare wire in the backshell. If the contact is replaced more than two times, you must replace the complete cable.

(2)Carefully remove the part of the contact that remains from the conductor.

NOTE : This procedure will permit you to remove 0.125 in. (3.18 mm) of the wire insulation from the conductor. If you do this procedure, each contact can be replaced two times.

(3)Prepare the end of the cable as follows :

(a)Use the PN 45-092 mechanical wire stripper or equivalent to remove 0.125 in. (3.18 mm) of the wire insulation from the end of the conductor.

(b)Make sure you can see 0.250 in. (6.35 mm) of the conductor.

(c)Remove only the quantity of insulation that is necessary to get this dimension.

H. Installation of the contact

(1)Get the correct replacement contacts.
  (a)Refer to the Aircraft Wiring List, Equipment List for the connector Function Identification Number (FIN) to get the correct part number.
  (b)To identify alternate part numbers, refer to the Power Plant Illustrated Parts Catalog.
(2)Crimp the contact as follows.
  (a)Use the crimp tool frame and the applicable crimp tool positioner given in the Standard Equipment for the correct contact type and wire gage.
  (b)Install the crimp tool positioner in the crimp tool frame as follows :
    1 Remove the lock clip from the lock ring on the positioner.
    2 Use the correct positioner which agrees with the contact type.
    3 Put the positioner in the tool frame lock plate and align the positioner pins with the lock plate ring slots.
    4 Push the positioner into the tool frame and turn the positioner 90 degrees in a clockwise direction until it locks in position.
    5 Install the lock clip on the positioner lock ring.
(3)Crimp the replacement contact to the wire as follows.
  CAUTION : DO NOT RELEASE THE LATCH FOR THE CRIMP POSITIONER IF THE CRIMP TOOL FRAME HANDLE IS IN THE CLOSED POSITION. THE TOOL HANDLE MUST BE OPEN WHEN THE POSITIONER IS INSTALLED, REMOVED OR RELEASED. INCORRECT USE CAN CAUSE DAMAGE TO THE POSITIONER AND CRIMP TOOL FRAME.
  (a)Remove the lock clip from the lock ring hole on the selector knob.
  (b)Raise and turn the tool frame selector knob until the number of the knob agrees with the number on the positioner data plate for the correct wire gage.
  (c)Install the lock clip in the lock ring hole.
  (d)Align the number on the knob with the index mark on the tool frame and release the knob.
    CAUTION : IF THE TOOL FRAME SELECTOR KNOB IS PUT IN THE WRONG POSITION, DAMAGE TO THE CONTACT AND WIRE CAN OCCUR. ALSO, THE CONTACT CAN BE LOOSELY CRIMPED ON THE WIRE.
  (e)Examine the wire to make sure the wire strands are not separated.
    1 If necessary, carefully twist the wire strands in their normal direction of twist to fit the contact wire hole.
  (f)Install the end of the conductor into the contact wire hole.
  (g)Push the conductor into the contact wire hole until you feel it touches the bottom.
    NOTE : If the insulation on the conductor was not removed correctly, the wire will not touch the bottom of the contact crimp barrel or there will be too much bare wire at the rear shoulder of the contact crimp barrel.
  (h)Examine the contact to make sure you can see the conductor strands through the sight hole in the contact.
  (i)Install the contact and conductor through the tool frame hole and into the positioner hole until it touches the bottom.
  (j)Move the tool frame handles together until the ratchet releases.
  (k)Remove the crimped contact from the tool frame.
  (l)Hold the wire tight and lightly pull on the contact to make sure the contact is crimped on the conductor.
  (m)Do these previous steps until you crimp all the contacts on the

conductors.

(4)Install the contacts on the connector as follows :

(a)Move the backshell rearward over the harness to permit the contacts to be inserted in the connector.

(b)Use the applicable contact insertion tool given in the standard equipment for the correct contact size.

(c)Install the insertion tool on the contact.

NOTE : Make sure you install the correct contact in the correct location.

(d)All contacts are installed and locked from the rear of the connector.

(e)Put the contact insertion tool on the wire.

(f)Hold the wire tight and move the tool rearward on the wire.

NOTE : This will permit the wire to go into the slot of the tool.

(g)Push the tool along the wire until the tip of the tool seats on the rear shoulder of the contact.

(h)Install the contact in the connector.

(i)Hold the connector in your hand.

(j)Use the label on the wire to identify the correct contact location.

1 Refer to the Aircraft Wiring List, 92-90 Master Wire List Data detailed wiring data.

CAUTION : IF TOO MUCH PRESSURE IS USED WHEN YOU INSTALL THE CONTACT INTO THE CONNECTOR, DAMAGE TO THE COLLET, CONTACT, AND GROMMET CAN OCCUR.

(k)Install the insertion tool with the wired contact, contacts that are not used, or stubwire assembly contact into the correct cavity at the rear of the connector with a strong and equal pressure.

(l)Remove the tool.

(m)Lightly pull back on the wire to feel if the contact is locked in the collet.

(n)Do these previous steps until you install all the contacts on the conductors.

(o)Install the larger end of the sealing plugs in the connector grommet of the contacts that are not used.

J. Do a contact retention check

(Ref. Fig. 005)

NOTE : All the contacts must be locked in the connector. This includes all unused contacts and stubwire assembly contacts.

NOTE : The contact retention force necessary to make sure the contact is locked in the connector is between 10 and 15 lfb (44.5 and 66.7 N).

(1)Use the correct retention test tool, replacement pin, and replacement socket tools that are given in the Standard Equipment for the correct contact size.

(a)Use the pin replacement tips when you do a test of the socket contacts.

(b)Use the socket replacement tips when you do a test of the pin contacts.

CAUTION : BE CAREFUL WHEN YOU DO A CHECK OF THE CONTACTS. INCORRECT USE OF THE RETENTION TEST TOOL COULD RESULT IN DAMAGE TO THE CONNECTORS CONTACT, COLLET, GROMMET AND TEST TOOL.

(2)Put the applicable 16 or 20 gage retention test tool and replacement pin or replacement socket on the contact so they are in a straight line.

(3)Keep this position when you do a test on each contact to get the most

accurate results.
(4)Apply hand pressure to the tester until the indicator band located on the replacement pin or socket is in line with the body of the tester.
(a)At this point, there is 13 lbf (57.8 N) of pressure applied.
(b)If the contact is still in position, the contact retention is satisfactory.
(5)Do these previous steps again for all the other contacts that were installed in the connector.

K. Install the backshell on the connector
(1)If necessary, install only the lacing tape (Material No.P05-245) you removed before. Refer to the Wire Harness Lacing Procedure (Ref. 70-71-14, P. Block 1) for the harness lacing procedures.
(2)Assemble the applicable connector and backshell. Refer to the Connector and Backshell Replacement Procedure (Ref. 70-71-20, P. Block 1).
(3)If necessary, assemble the adapter plate to the connector. Refer to the Adapter Plate Replacement Procedure (Ref. 70-71-25, P. Block 1).

L. Do the electrical checks
CAUTION : DO NOT BEND OR PUT STRESS ON THE CONTACTS WHEN YOU DO THE TEST. DAMAGE TO THE CONNECTOR OR CONTACT CAN OCCUR.
(1)Use the TG-69 pliers or the TG-70 strap wrench to disconnect the wire harness connectors which attach to the ends of the circuits that you will do a test of.
(2)Do the wire continuity check as follows :
(a)Do a wire continuity check on all the contacts from point-to-point (from one end of the wire to the other end of the wire).
R (b)Use a digital multimeter or ohmmeter.
(c)Measure the resistance on all circuits.
(d)Each circuit must have continuity from one end of the wire to the other end of the wire.
NOTE : Refer to the Aircraft Wiring List, 92-90 Master Wire List for detailed pin-to-pin and wire color data.
(3)Do the insulation resistance check as follows :
WARNING : DO NOT USE A MEGOHMMETER FOR THE INSULATION RESISTANCE TEST OF THE ON-WING WIRE REPAIR. THIS COULD RESULT IN INJURY TO PERSONS OR DAMAGE TO THE AIRPLANE.
CAUTION : YOU MUST DISCONNECT ALL THE CONNECTORS ON THE CIRCUIT WHICH YOU WILL CHECK. IF YOU DO NOT DO THIS, IT CAN CAUSE UNSATISFACTORY RESISTANCE INDICATIONS AND POSSIBLE DAMAGE TO THE CIRCUITS.
CAUTION : DO NOT BEND OR PUT STRESS ON THE CONTACTS WHEN YOU DO THE TEST. DAMAGE TO THE CONNECTOR OR CONTACT CAN OCCUR.
R (a)Use a digital multimeter or ohmmeter.
(b)Set the ohmmeter to the 100K ohm scale.
(c)Attach the ohmmeter test leads for insulation resistance check (wire to wire) as follows :
1 Attach one ohmmeter test lead to one contact.
2 Connect the other lead to the other contacts, one at a time, which do not connect to the same circuit.
3 Measure the insulation resistance.

4 The resistance must be a minimum of 100K ohms.
5 Do the procedure again for all the other wires you will do a test of.

(d)Attach the ohmmeter test leads for insulation resistance check (wire to ground) as follows :
1 Attach one ohmmeter test lead to the backshell.
2 Connect the other lead to all contacts, one at a time.
3 Measure the insulation resistance.
4 The resistance must be a minimum of 100K ohms.
5 Do the procedure again for all the other wires you will do a test of.

(e)Remove the ohmmeter leads.

M. Connect the connectors

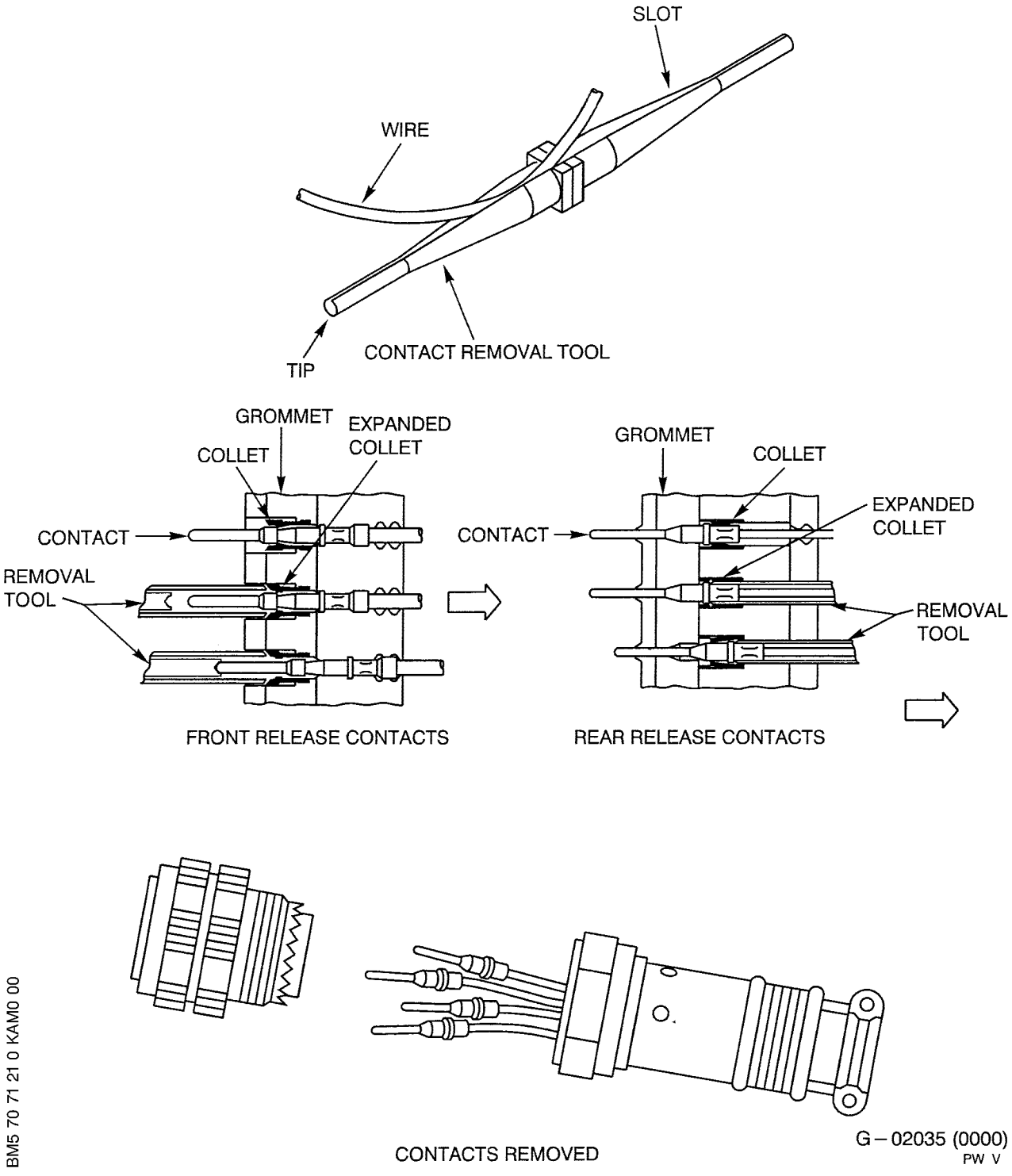
CAUTION : USE THE CORRECT ASSEMBLY PROCEDURE AND TOOLS WHEN YOU INSTALL THE HARNESS CONNECTOR. IF YOU DO NOT, THE CONNECTOR CAN BECOME LOOSE OR DAMAGED. A LOOSE CONNECTOR CAN CAUSE THE ENGINE TO OPERATE INCORRECTLY WITH THE RISK OF AN IN FLIGHT SHUTDOWN.

CAUTION : DO NOT USE A METAL JAWED TOOL TO TIGHTEN THE CONNECTOR. THIS WILL CAUSE DAMAGE TO THE CONNECTOR.

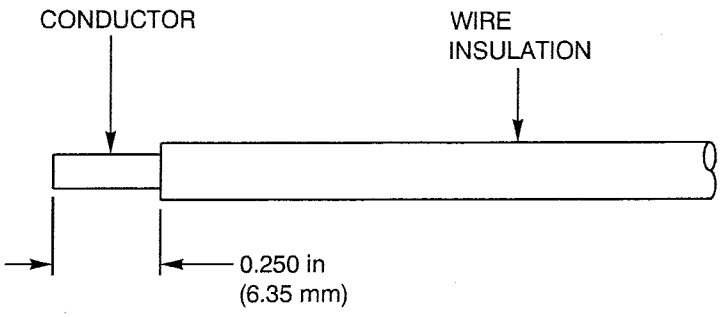
(1)Connect the self-locking electrical connector as follows and in the correct sequence as shown below.
(a)Examine, align the keyway, and engage the connector.
(b)Push lightly inward on the connector while tightening the coupling ring.
(c)Use the soft jaw pliers or the strap wrench and tighten the connector against the receptacle.
(d)While you tighten, push the connector in and from side to side.
(e)Make sure you can feel the ratchet feature.
(f)Tighten the connector until the pliers or strap wrench slip on the connector ring.

N. Test the Engine

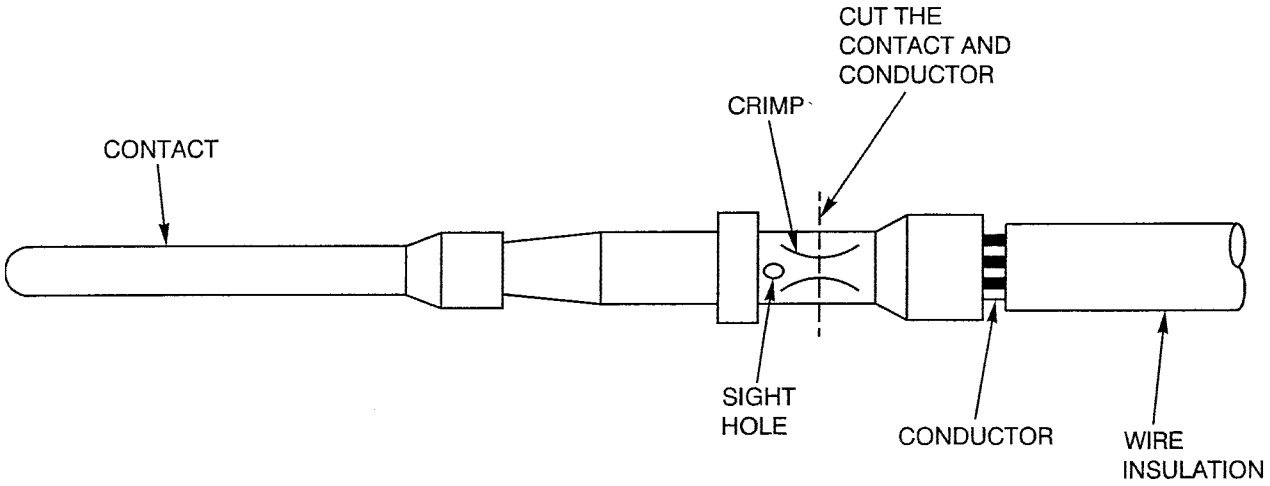
(1)Test the engine. Refer to the specific AMM Test Reference Table, Test Requirements After Engine/Module/Component Repairs or Replacement (Ref. 71-00-00, P. Block 501).



Contact Replacement Procedure
Figure 001



CONDUCTOR DIMENSION

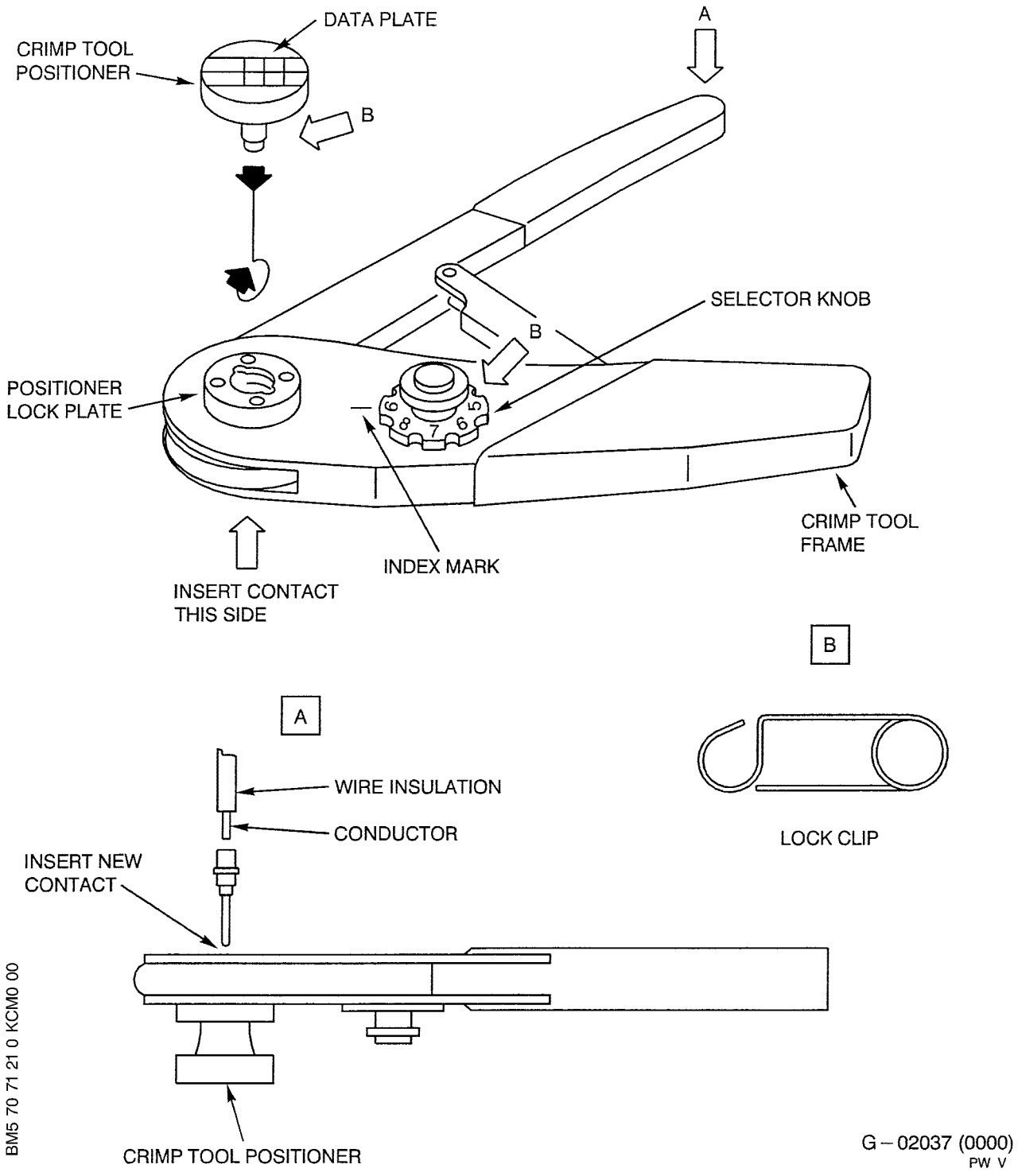


INSTALLED CONTACT

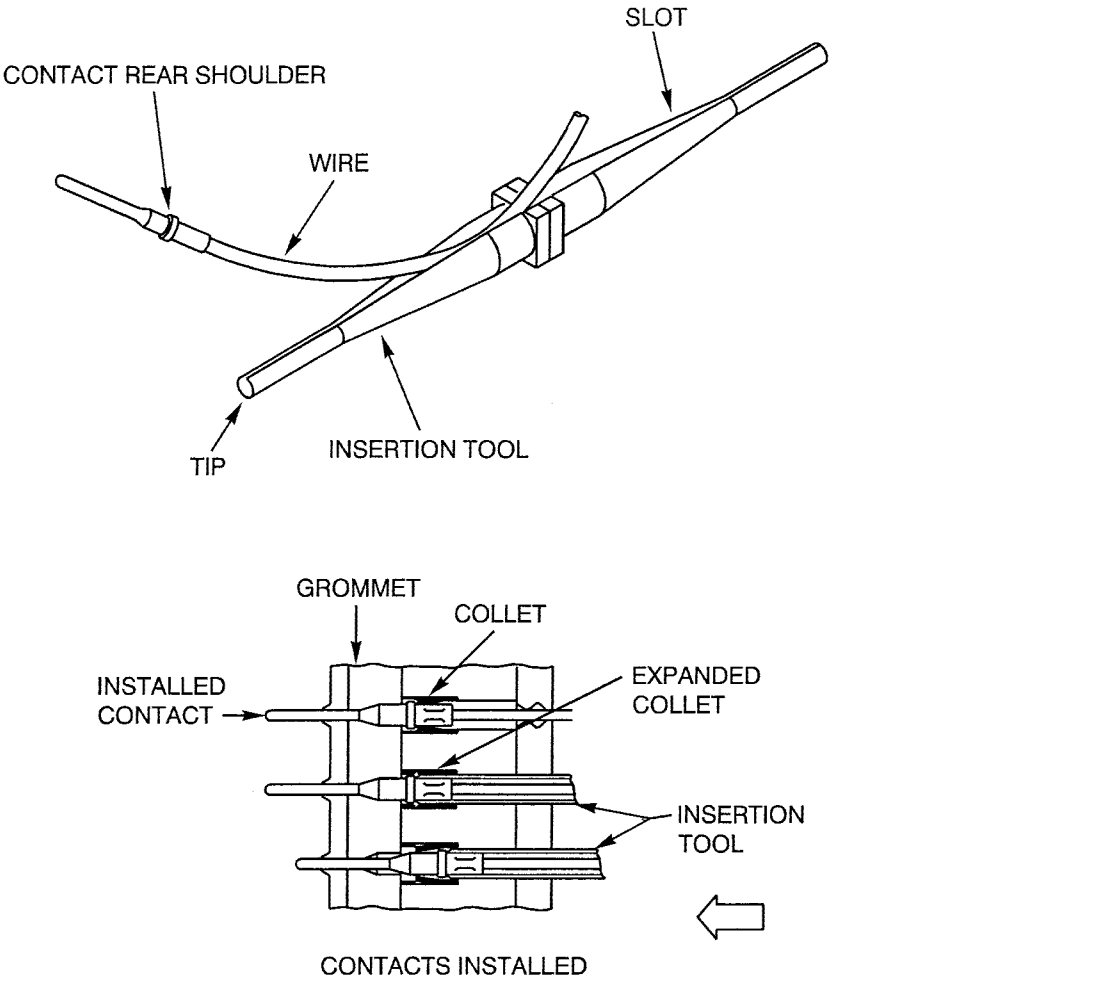
BM5 70 71 21 0 KBM0 00

G – 02045 (0000)
PW V

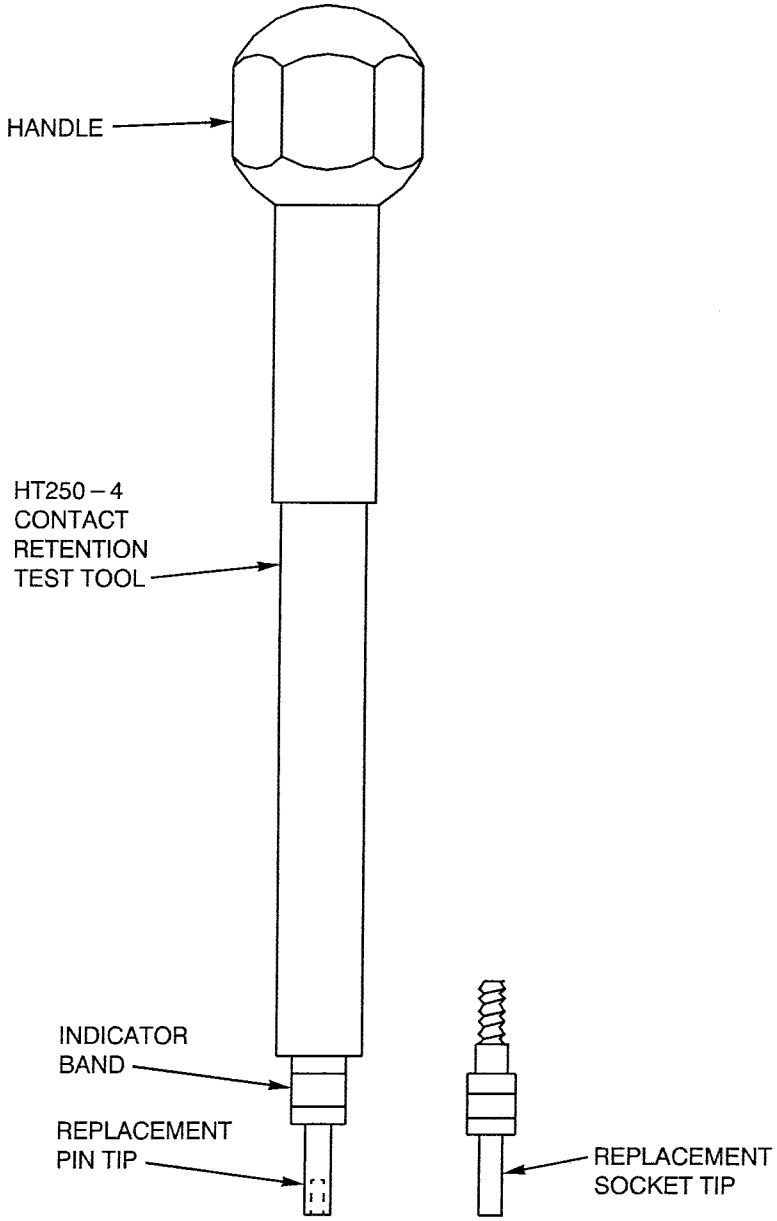
Contact Replacement Procedure
Figure 002



Contact Replacement Procedure
Figure 003



Contact Replacement Procedure
Figure 004



BM5 70 71 21 0 KEM0 00

G – 02042 (0000)
PW V

Contact Replacement Procedure
Figure 005

WIRING - CABLE JACKET REPAIR - DESCRIPTION AND OPERATION

1. Cable Jacket Repair Procedure

A. Reason for the Job

(1)Use this procedure to repair damage on the outer jacket of the cable.

B. Equipment and Materials

ITEM	DESIGNATION
(a)Material No.P05-005	Special Materials (Ref. 70-00-00)
(b)Material No.P05-246	Special Materials (Ref. 70-00-00)
(c)Material No.P05-247	Special Materials (Ref. 70-00-00)
(d)Material No.P11-014	Cleaning Agents (Ref. 70-00-00)
Referenced Procedures	
- 70-00-00, P. Block 201	Standard Practices - General
- 70-71-14, P. Block 1	Wiring - Harness Lacing
- 70-71-24, P. Block 1	Wiring - Shielded Wire Replacement

C. General

WARNING : DO NOT USE HEAT GUNS, SOLDERING GUNS OR SOLDERING IRONS FOR THE ON-WINGS REPAIRS. THEY ARE NOT RESISTANT TO EXPLOSION AND CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(1)This chapter gives the procedure to repair damage on the outer jacket of the cable.

(2)These are the wire harness parts :

(a)Wire - A single electrical conductor with insulation around it.

(b)Cable - A group of wires in a metal shield and an insulated jacket.

(c)Harness - A single cable or two or more cables with connectors or terminal lugs attached to the ends of the cables.

(3)To identify the correct adapter assembly part number, refer to the applicable wire harness located in the Power Plant Illustrated Part Catalog. Standard equipment and consumable materials can be replaced with equivalent items.

(4)Consumable materials can be replaced with equivalent items.

D. Cable Jacket Repair Limits

(1)If the damage is more than the repair limits that follow, replace the harness or cable. Refer to the Shielded Wire Replacement Procedure (Ref. 70-71-24, P. Block 1).

(a)No damage is permitted on the braided shields located under the cable jacket.

(b)The braided shield shows through the cable jacket a maximum of 50 percent around the cable.

(c)The braided shield shows through the cable jacket a maximum of 2.0 in. (50.8 mm) along the cable.

E. Procedure - Cable Jacket Repair Procedure

(1)Always obey the specific procedures and limits in the specific AMM

maintenance tasks.

(2)Remove the lacing tape as necessary to get sufficient access to the damaged cables.

(3)If necessary, loosen or remove the clamp bolts and the harness to get sufficient access to the damaged cable.

WARNING : ISOPROPYL ALCOHOL IS FLAMMABLE AND DANGEROUS TO THE SKIN, EYES AND RESPIRATORY TRACT. SKIN AND EYE PROTECTION IS NECESSARY. DO NOT HANDLE FOR LONG PERIODS AT A TIME. USE IN AN AREA WITH GOOD VENTILATION.

(4)Clean the cable 3.0 in. (76.2 mm) on each side of the damage with a clean lint-free cotton cloth (Material No.P05-005) wet with a small amount of isopropyl alcohol (Material No.P11-014).

(5)Wind one layer of the electrical silicone tape (Material No.P05-247) around the cable with a 20 percent overlap on each turn of the tape.

(a)Extend the tape 1.0 in. (25.4 mm) more on each side of the worn area of the insulated jacket.

(6)In the opposite direction wind one layer of the electrical silicone tape (Material No.P05-246) over the first layer of tape with a 20 percent overlap on each turn of the tape.

(a)Extend the tape 0.5 in. (12.7 mm) more on each side of the first layer of tape.

(7)Tie the wire harness with lacing tape as necessary.

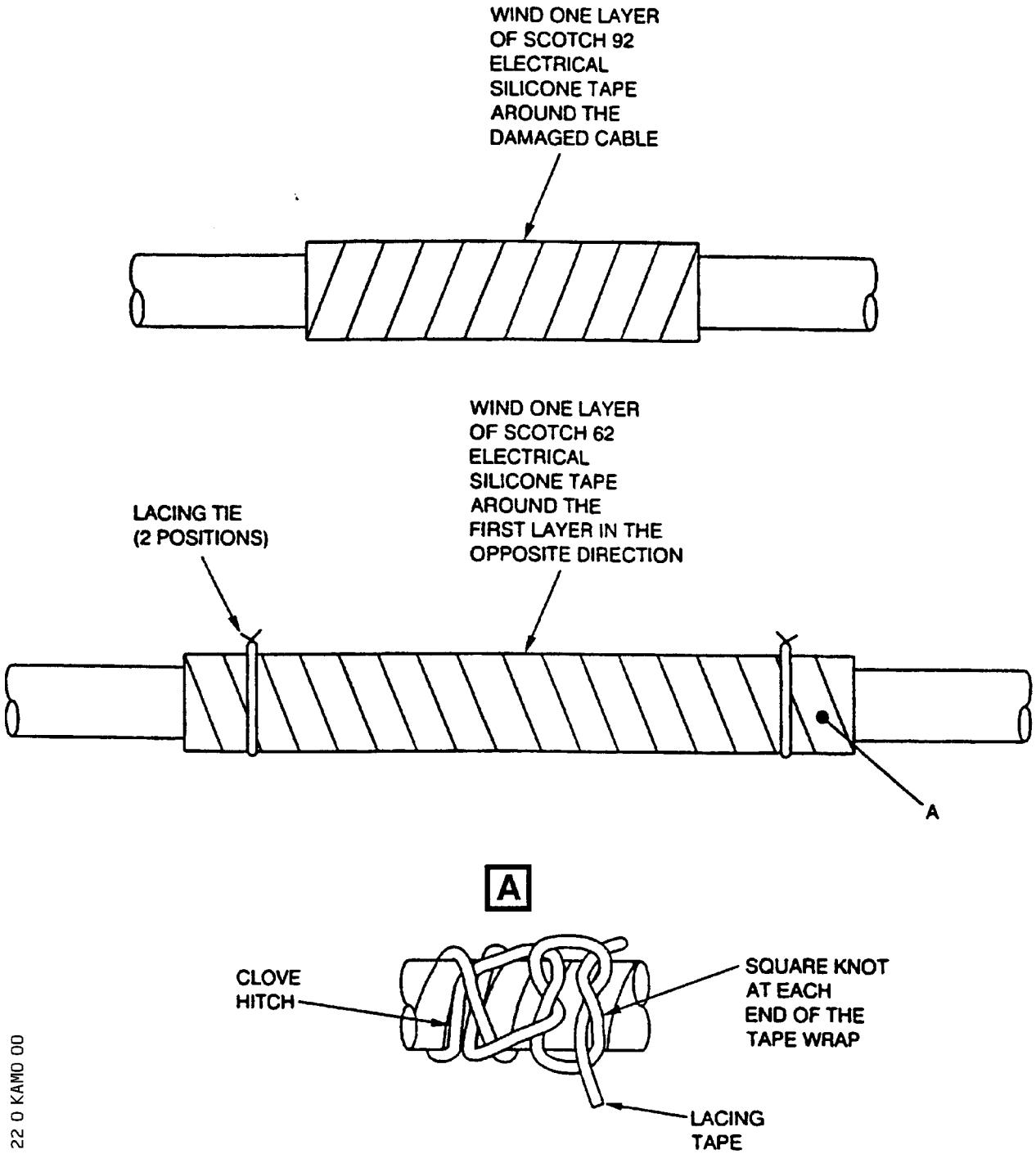
(a)Refer to the Wire Harness Lacing Procedure (Ref. 70-71-14, P. Block 1).

(8)If necessary, put the harness back in the harness clamps.

NOTE : You must keep the tracer cord located on the outboard side of the harness when you put the harness in the hinged clamps.

(9)TORQUE the clamp bolts to between 36 and 40 lbf.in. (0.41 and 0.45 m.daN).

(Ref. Fig. 001)


WIND ONE LAYER OF SCOTCH 92 ELECTRICAL SILICONE TAPE AROUND THE DAMAGED CABLE
WIND ONE LAYER OF SCOTCH 62 ELECTRICAL SILICONE TAPE AROUND THE FIRST LAYER IN THE OPPOSITE DIRECTION
LACING TIE (2 POSITIONS)
A
A
CLOVE HITCH
SQUARE KNOT AT EACH END OF THE TAPE WRAP
LACING TAPE
G – 02090 (0000)

BM5 70 71 22 0 KAM0 00

Cable Jacket Repair
Figure 001

WIRING - WIRE (SPLICE) REPAIR - DESCRIPTION AND OPERATION

1. Wire (Splice) Repair Procedure

A. Reason for the Job

(1)Use this procedure to do a splice repair of a wire harness.

B. Equipment and Materials

ITEM	DESIGNATION
(1)Material No.P05-245	Special Materials (Ref. 70-00-00)
(2)Material No.P05-246	Special Materials (Ref. 70-00-00)
(3)Material No.P05-247	Special Materials (Ref. 70-00-00)
(4)Material No.P05-248	Special Materials (Ref. 70-00-00)
(5)NEQ241636SP	Tubular Braid (0.250 Diameter, Silver Plated Copper) (Available from Supplier Code 74116)
(6)No specific	Shield Terminating Ferrule (Inner GSB Series) (Available from Supplier Code 56501)
(7)No specific	Shield Terminating Ferrule (Outer GSC Series) (Available from Supplier Code 56501)
Referenced Procedures	
- 70-00-00, P. Block 201	Standard Practices - General
- 70-71-14, P. Block 1	Wiring - Harness Lacing Procedure
- 71-00-00, P. Block 501	Power Plant - General

(1)Fixtures, Tools, Test and Support Equipment

NOTE : Refer to 70-00-00, P. Block 201 for Supplier Source Code List.

PART NUMBER	SUPPLIER CODE	NOMENCLATURE	APPLICATION
TG-70	11851 or 06324	Strap Wrench	Used to disconnect and connect electrical connectors.
Or			
TG-69	11851 or 06324	Soft Jaw Pliers	Used to disconnect and connect electrical connectors.
WT-440	56501	Outer Ferrule Crimp Tool	Used to crimp ferrules on outer shield braid.
Or			
WT-540	56501	Outer Ferrule Crimp Tool	Used to crimp ferrules on outer shield braid.
Model WT-2000	56501	Wire Splice Crimp Tool	Used to crimp wire splices.

PART NUMBER	SUPPLIER CODE	NOMENCLATURE	APPLICATION
Strip Master No. 45092	30119	Wire Stripper	Used to strip wire insulation.
R Model 177 (see NOTE 1)	80164	Digital Multimeter (100 ohm scale)	Used to measure continuity.
R Model 260 (see NOTE 2)	16902	Ohmmeter (100 ohm scale)	Used to measure continuity.
2B18-16 or equivalent	56501	Splice	Use to overlap splice 16-18 gage wire.
2A22-20 or equivalent	56501	Splice	Use to overlap splice 20-22 gage wire.

R NOTE 1 : It is not necessary to use Model 177. An equivalent digital
R multimeter, available by local purchase, is permitted to use.
R NOTE 2 : It is not necessary to use Model 260. An equivalent ohmmeter,
R available by local purchase, is permitted to use.

INNER FERRULE TYPE GSB-	OUTER FERRULE TYPE GSC-	WT440/WT540 CRIMP TOOL DIE No.	ELECTRICAL CABLE DESCRIPTION
GSB-205 ORANGE	GSC-312 YELLOW	4415	2 WIRES (18 AND 20 GAGE) OR 3 WIRES (20 GAGE)
GSB-205 ORANGE	GSC-327 TIN	4416	2 WIRES (16 GAGE)
GSB-219 TIN	GSC-327 TIN	4416	2 WIRES (16 AND 18 GAGE) OR 3 WIRES (18 AND 20 GAGE)
GSB-232 RED	GSC-348 ORANGE	4417	4 WIRES (20 GAGE)
GSB-250 GREEN	GSC-359 PURPLE	5450	3 WIRES (16, 18 AND 20 GAGE)
GSB-261 BLUE	GSC-375 YELLOW	5451	2 WIRES (18 GAGE)
GSB-275 ORANGE	GSC-375 YELLOW	5451	3 WIRES (20 GAGE)

D. General

WARNING : DO NOT USE HEAT GUNS, SOLDERING GUNS OR SOLDERING IRONS FOR THE ON-WING REPAIRS. THEY ARE NOT RESISTANT TO EXPLOSION AND CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(1)This chapter gives the procedure to splice a wire on an electrical wire harness assembly.

(2)There are two general types of harnesses that you can use this repair for.

(a)Shielded harnesses - These harnesses have braided shields over the harness cables.

(b)Unshielded harnesses - These harnesses do not have braided shields over the harness cables.

(3)These are the wire harness parts :

(a)Wire - A single electrical conductor with insulation around it.

(b)Cable - A group of wires in a metal shield and an insulated jacket.

(c)Harness - A single cable or two or more cables with connectors or terminal lugs attached to the ends of the cables.

(4)Refer to the Wire Harness Lacing Procedure (Ref. 70-71-14, P. Block 1) for the harness lacing procedures.

(5)Standard equipment and consumable materials can be replaced with equivalent items.

(6)Always obey the specific procedures and limits in the specific AMM maintenance tasks.

E. Cable Preparation - (Unshielded Cable Applications)
(Ref. Fig. 001) (Sheet 1)

(1)Remove the cable jacket away from the splice location as follows :

(a)Carefully trim the cable jacket only enough to do the splice repair.

1 Do not cut into any of the wire insulation.

(b)If more than one wire needs a splice, the splice locations must not be opposite to each other.

(2)Use the wire stripper to strip the wire insulation so the wire conductor is installed completely into the splice.

(a)The end of the conductor must be even with the end of the splice so that the end of each conductor is shown at each end of the splice.

(b)This is not a butt-to-butt splice.

F. Cable Preparation - (Shielded Cable Applications)
(Ref. Fig. 001) (Sheet 2)

(1)Remove the cable jacket and braided shield away from the splice location as follows :

(a)Carefully trim the cable jacket and braided shield only enough to do the splice repair.

1 Do not cut into any of the wire insulation.

2 Make sure that 0.750 in. (19.050 mm) or more of the braided shield is shown.

(b)If more than one wire needs a splice, the splice locations must not be opposite to each other.

(2)Use the wire stripper to strip the wire insulation so the wire conductor is installed completely into the splice.

(a)The end of the conductor must be even with the end of the splice so

that the end of each conductor is shown at each end of the splice.
(b)This is not a butt-to-butt splice.
(3)Install the outer ferrules, the braid, and inner ferrules on the shielded cable as follows.
(a)Use the table in the Fixtures, Tools, Test and Support Equipment paragraph to get the correct inner and outer ferrules.
(b)Install one outer ferrule on each end of the cable to be spliced. Move the ferrules away from the repair area.
(c)Install one inner ferrule on each end of the cable to be spliced. Move the ferrules away from the repair area.
(d)Cut a length of tubular braid (silver plated) to cover the splice repair area from ferrule location to ferrule location.
(e)Expand and install the tubular braid over one end of the cable to be spliced. Move the braid away from the repair area.

G. Splice the Wire
(1)Install each end of the wires into the correct wire splice.
(a)The end of the conductor must be even with the end of the splice so that the end of each conductor is shown at each end of the splice.
(b)This is not a butt-to-butt splice.
(2)Use the correct wire splice crimp tool and crimp each splice as shown.
(3)Examine the splice repair and make sure that there is no more than 0.125 in. (3.175 mm) between the splice and the wire insulation.
(4)Do these steps for each of the wires that you must splice.

H. Wrap the Wire Splice
(1)Wrap two layers of silicone rubber tape (Material No.P05-248) directly over the splice. Use a 50 percent overlap with the second layer wrapped opposite to the first layer.
(2)Spiral wrap two layers of electrical tape (Scotch 92) (Material No.P05-247) beyond the repair area and onto the wire insulation. Use a 50 percent overlap with the second layer wrapped opposite to the first layer and tight enough to produce a moisture resistant seal.
(3)Do these steps for each of the wires that you must wrap.

J. Wrap the cable outer jacket - (Unshielded Cable Applications) (Ref. Fig. 002) (Sheet 1)
(1)Wrap the splice and cable for abrasion protection as follows :
(a)Spiral wrap two layers of electrical tape (Scotch 62) (Material No.P05-246) beyond the repair area and onto the cable jacket. Use a 50 percent overlap with the second layer wrapped opposite to the first layer and extend the wrap 1 in. (25.400 mm) beyond the initial tape wrap.
(2)Tie each end of the tape with lacing tape as follows :
(a)Tie each end of the tape in place with lacing tape (Material No.P05-245).
(b)Use a clove hitch and square knot. Tighten the clove hitch firmly before you tie the square knot.
(c)Cut off the free ends of the lacing tape to 0.250 - 0.500 in. (6.4 - 12.7 mm) long.

K. Repair the braided shield and wrap the cable outer jacket -
(Shielded Cable Applications)
(Ref. Fig. 002) (Sheet 2)

(1)Make the metal strands of the braided shield straight on each side of the spliced area.
(2)Put the inner ferrule near the end of the cable jacket and fold the braided shield back over the ferrule. Make sure the metal strands of the braided shield are equally spaced around the ferrule.
(3)Put one end of the tubular braid over the metal strands of the braided shield and move the outer ferrule over the tubular braid and the inner ferrule.
(4)Use the correct size crimp tool and crimp the outer ferrule.
(5)Pull the tubular braid tight across the splice area.
(6)Put the other inner ferrule near the end of the cable jacket and fold the braided shield back over the ferrule. Make sure the metal strands of the braided shield are equally spaced around the ferrule.
(7)Put the other end of the tubular braid over the metal strands of the braided shield and move the outer ferrule over the tubular braid and the inner ferrule.
(8)Use the correct size crimp tool and crimp the outer ferrule.
(9)Wrap the splice and cable for abrasion protection as follows :
(a)Spiral wrap two layers of electrical tape (Scotch 62) (Material No.P05-246) beyond the repair area and onto the cable jacket. Use a 50 percent overlap with the second layer wrapped opposite to the first layer and extend the wrap 1 in. (25.400 mm) beyond the initial tape wrap.
(10)Tie each end of the tape with lacing tape as follows :
(a)Tie each end of the tape in place with lacing tape (Material No.P05-245).
(b)Use a clove hitch and square knot. Tighten the clove hitch firmly before you tie the square knot.
(c)Cut off the free ends of the lacing tape to 0.250 - 0.500 in. (6.4 - 12.7 mm) long.

L. Do the electrical checks

CAUTION : DO NOT BEND OR PUT STRESS ON THE CONTACTS WHEN YOU DO THE TEST. DAMAGE TO THE CONNECTOR OR CONTACT CAN OCCUR.

(1)Use the TG-69 pliers or the TG-70 strap wrench to disconnect the wire harness connectors which attach to the ends of the circuits that you will do a test of.
(2)Do the wire continuity check as follows :
(a)Do a wire continuity check on all the contacts from point-to-point (from one end of the wire to the other end of the wire).
R (b)Use a digital multimeter or ohmmeter.
(c)Measure the resistance on all circuits.
(d)Each circuit must have continuity from one end of the wire to the other end of the wire.
(3)Do the insulation resistance check as follows :

WARNING : DO NOT USE A MEGOHMMETER FOR THE INSULATION RESISTANCE TEST OF THE ON-WING WIRE REPAIR. THIS COULD RESULT IN INJURY TO PERSONS OR DAMAGE TO THE AIRPLANE.

CAUTION : YOU MUST DISCONNECT ALL THE CONNECTORS ON THE CIRCUIT WHICH YOU WILL CHECK. IF YOU DO NOT DO THIS, IT CAN CAUSE UNSATISFACTORY RESISTANCE INDICATIONS AND POSSIBLE DAMAGE TO THE CIRCUITS.

CAUTION : DO NOT BEND OR PUT STRESS ON THE CONTACTS WHEN YOU DO THE TEST. DAMAGE TO THE CONNECTOR OR CONTACT CAN OCCUR.

R (a)Use a digital multimeter or ohmmeter.
(b)Set the ohmmeter to the 100K ohm scale.
(c)Attach the ohmmeter test leads for insulation resistance check (wire to wire) as follows :
1 Attach one ohmmeter test lead to one contact.
2 Connect the other lead to the other contacts, one at a time, which do not connect to the same circuit.
3 Measure the insulation resistance.
4 The resistance must be a minimum of 100K ohms.
5 Do the procedure again for all the other wires you will do a test of.
(d)For shielded cables, attach the ohmmeter test leads for insulation resistance check (wire to ground) as follows :
1 Attach one ohmmeter test lead to the backshell.
2 Connect the other lead to all contacts, one at a time.
3 Measure the insulation resistance.
4 The resistance must be a minimum of 100K ohms.
5 Do the procedure again for all the other wires you will do a test of.
(e)Remove the ohmmeter leads.

M. Connect the connectors

CAUTION : USE THE CORRECT ASSEMBLY PROCEDURE AND TOOLS WHEN YOU INSTALL THE HARNESS CONNECTOR. IF YOU DO NOT, THE CONNECTOR CAN BECOME LOOSE OR DAMAGED. A LOOSE CONNECTOR CAN CAUSE THE ENGINE TO OPERATE INCORRECTLY WITH THE RISK OF AN IN FLIGHT SHUTDOWN.

CAUTION : DO NOT USE A METAL JAWED TOOL TO TIGHTEN THE CONNECTOR. THIS WILL CAUSE DAMAGE TO THE CONNECTOR.

(1)Connect the self-locking electrical connector as follows and in the correct sequence as shown below :
(a)Examine, align the keyway and engage the connector.
(b)Push lightly inward on the connector while tightening the coupling ring.
(c)Use the soft jaw pliers or the strap wrench and tighten the connector against the receptacle.
(d)While you tighten, push the connector in and from side to side.
(e)Make sure you can feel the ratchet feature.
(f)Tighten the connector until the pliers or strap wrench slip on the connector ring.
(2)Connect the non-self-locking electrical connector as follows and in the correct sequence as shown below :
(a)Examine, align the keyway and engage the connector.
(b)Push lightly inward on the connector while tightening the coupling

ring.

(c)Use the soft jaw pliers or the strap wrench and tighten the connector against the receptacle.

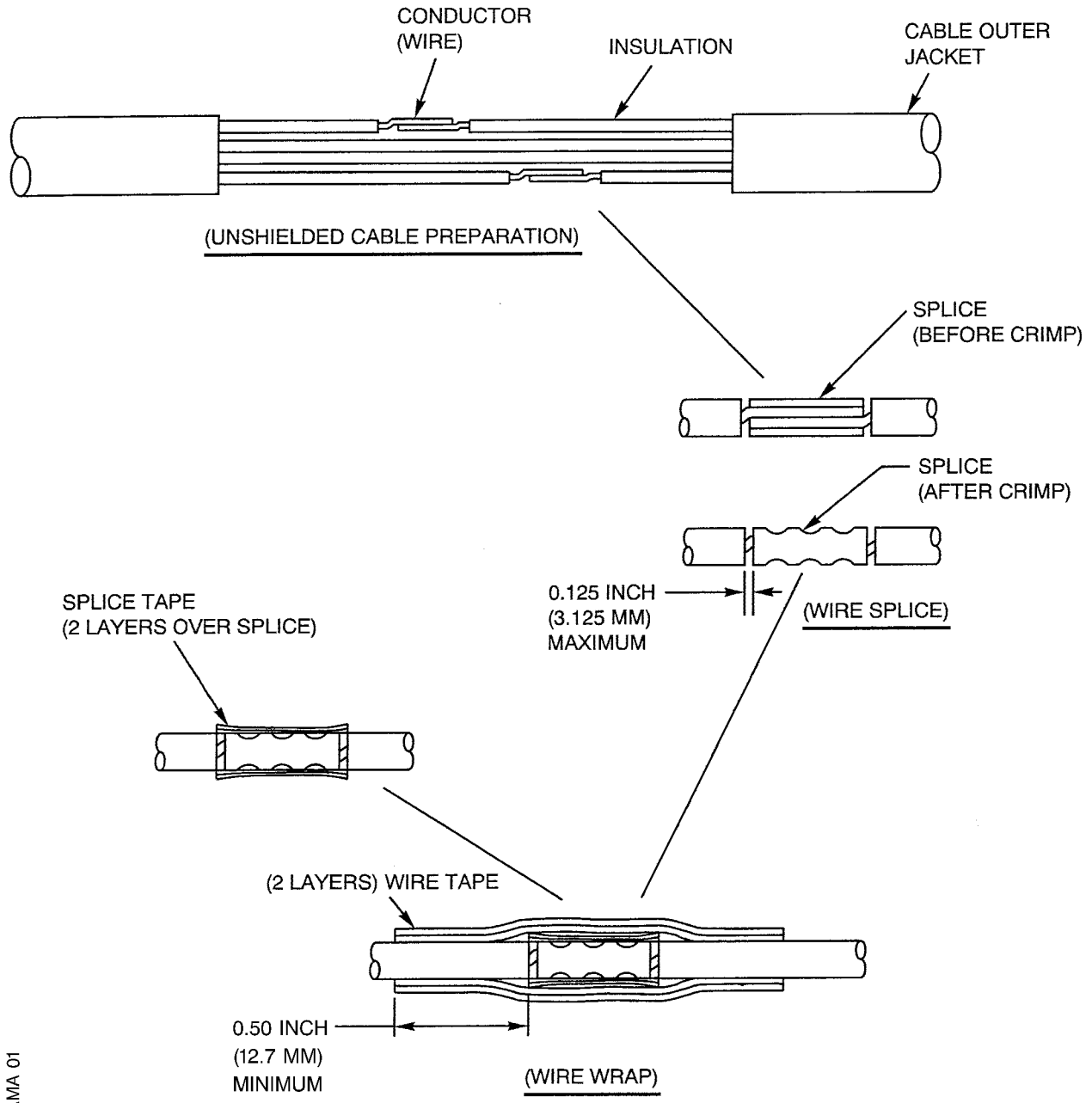
(d)While you tighten, push the connector in and from side to side.

(e)Tighten the connector until the pliers or strap wrench slip on the connector ring.

(f)Safety the connector with lockwire (Material No. P05-287).

N. Test the Engine

(1)Test the engine. Refer to the specific AMM Test Reference Table, Test Requirements After Engine/Module/Component Repairs or Replacement (Ref. 71-00-00, P. Block 501).

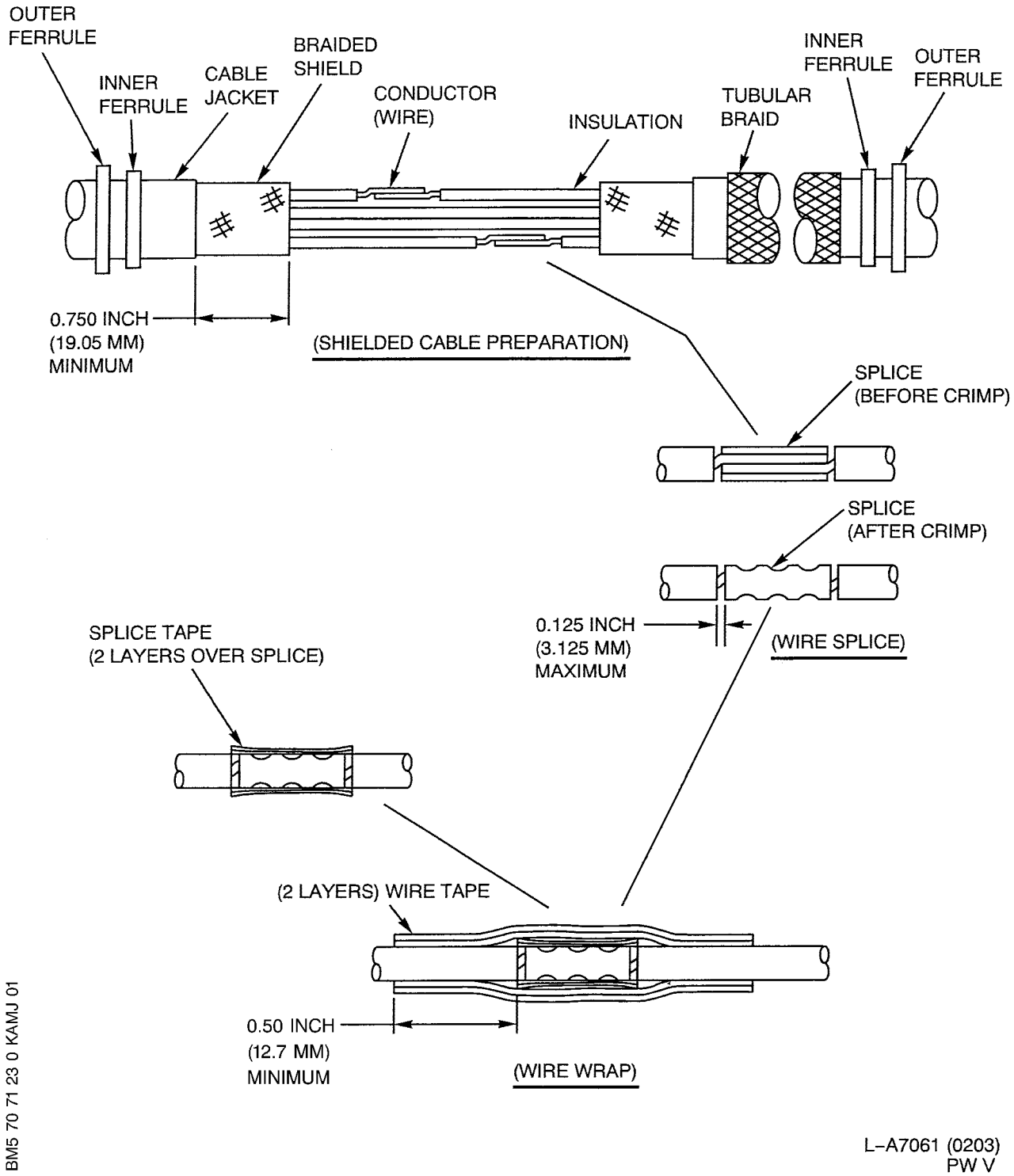


BM5 70 71 23 0 KAMA 01

L-A7060 (0902)
PW V

Wire (Splice) Repair Procedure -
(Unshielded Cable Applications) (Sheet 1/2)
Figure 001

R

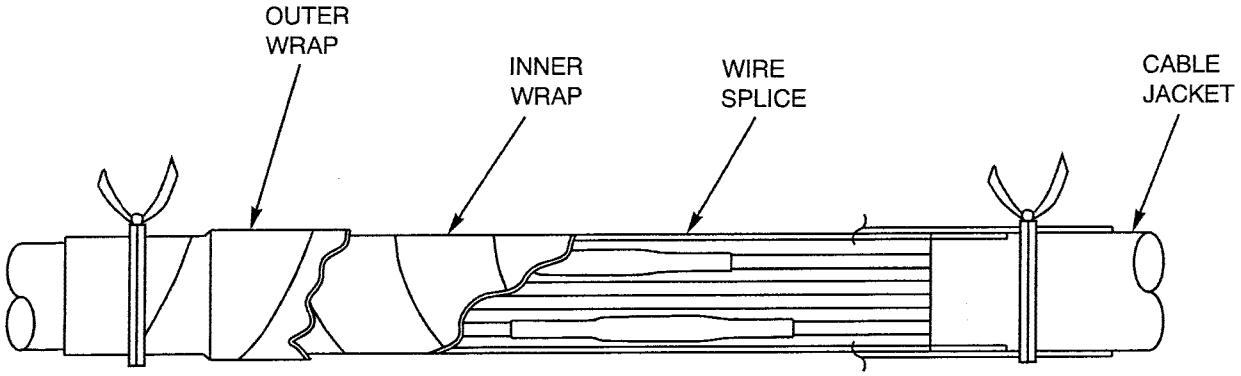


BM5 70 71 23 0 KAMJ 01

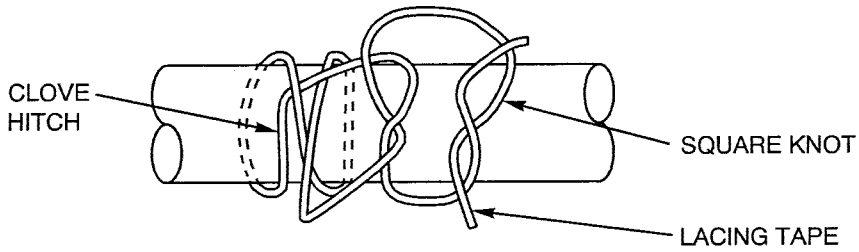
L-A7061 (0203)
PW V

Wire (Splice) Repair Procedure -
(Shielded Cable Applications) (Sheet 2/2)
Figure 001

R



(UNSHIELDED CABLE WRAP)



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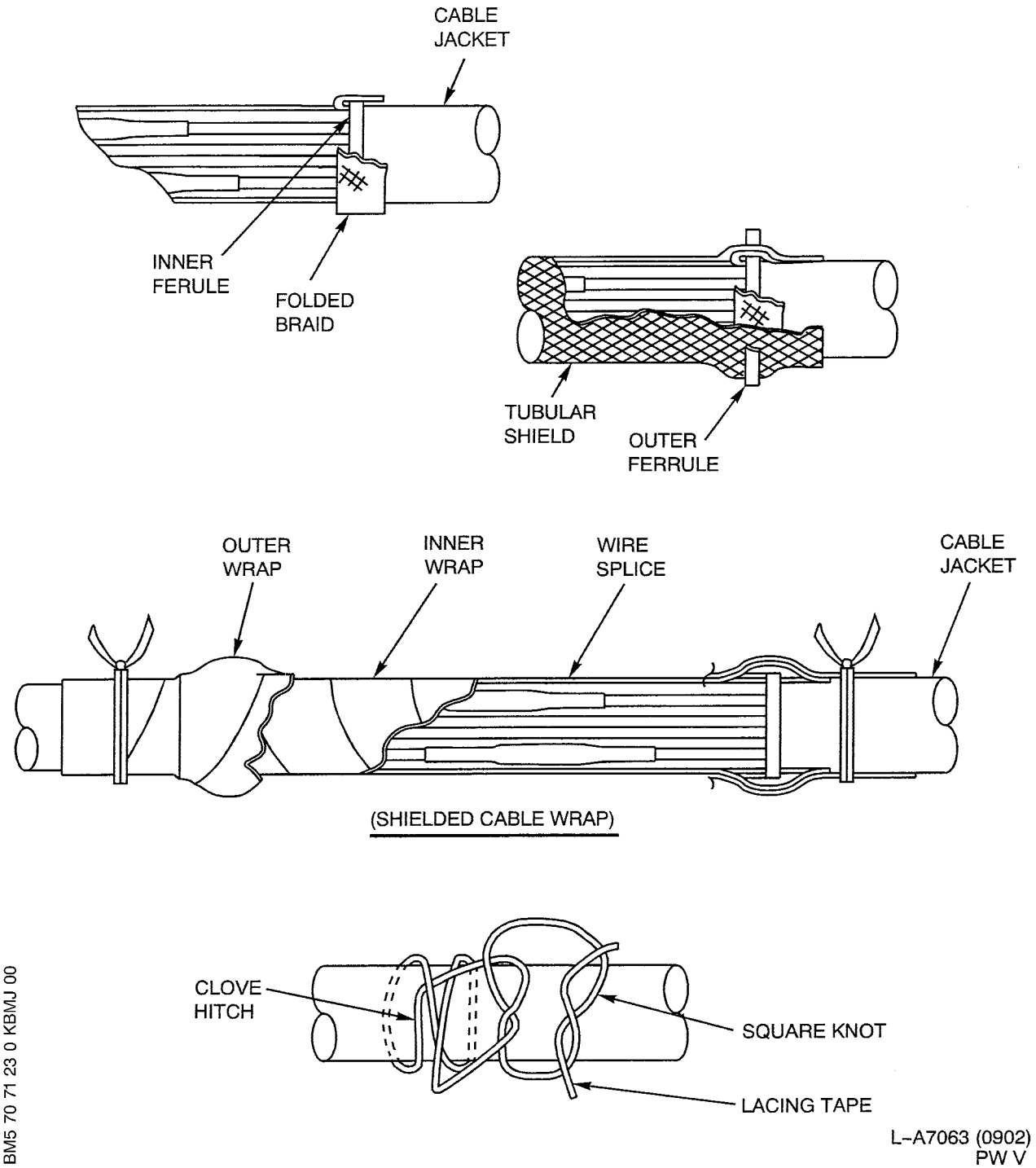
L-A7062 (0902)
PW V

Wire (Splice) Repair Procedure -
(Unshielded Cable Applications) (Sheet 1/2)
Figure 002

R



BM5 70 71 23 0 KBMJ 00

Wire (Splice) Repair Procedure -
(Shielded Cable Applications) (Sheet 2/2)
Figure 002

R

R WIRING - SHIELDED WIRE REPLACEMENT

R 1. Shielded Cable Replacement Procedure

A. Reason for the Job
(1)Use this procedure to replace a damaged or open circuit cable with a new shielded cable.

B. Equipment and Materials

ITEM	DESIGNATION
(1)Material No.P03-001	Oils (Ref. 70-00-00)
(2)Material No.P05-245	Special Materials (Ref. 70-00-00)
(3)Material No.P05-248	Special Materials (Ref. 70-00-00)
Referenced Procedures	
- 70-00-00, P. Block 201	Standard Practices - General
- 70-71-12, P. Block 1	Wiring - Connector/Insert Arrangement
- 70-71-14, P. Block 1	Wiring - Harness Lacing
- 70-71-20, P. Block 1	Wiring - Connector and Backshell Replacement
- 70-71-25, P. Block 1	Wiring - Harness Adapter Plate Replacement
- 71-00-00, P. Block 501	Power Plant - General

C. Standard Tools
(1)Fixtures, Tools, Test and Support Equipment

	PART NUMBER	SUPPLIER CODE	NOMENCLATURE	APPLICATION
	TG-70	11851 or 06324	Strap Wrench	Used to disconnect and connect electrical connectors.
	or			
	TG-69	11851 or 06324	Soft Jaw Pliers	Used to disconnect and connect electrical connectors.
	MS27495A16	11851	Insertion Tool 16 Gage	Used to install 16 gage contacts.
R				(MIL-DTL-26500
R				Connector supersedes
R				MIL-C-26500.)
	MS27495A20	11851	Insertion Tool 20 Gage	Used to install 20 gage contacts.
R				(MIL-DTL-38999
R				Connector supersedes
R				MIL-C-38999.)
	MS24256R16	11851	Removal Tool 16 Gage	Used to remove 16 gage contacts.
R				(MIL-DTL-26500
R				Connector supersedes
R				MIL-C-26500.)
	MS27495R20	11851	Removal Tool 20 Gage	Used to remove 20 gage contacts.
R				(MIL-DTL-38999
R				Connector supersedes
R				MIL-C-38999.)
	M83723/31-16	11851	Insertion/Removal Tool 16 Gage	Used to remove and install 16 gage
R				contacts.
R				(MIL-DTL-83723
R				connector supersedes
R				MIL-C-83723 and
R				MIL-DTL-5015 connector
R				supersedes MIL-C-5015).
	M83723/31-20	11851	Insertion/Removal Tool 20 Gage	Used to remove and install 20 gage
R				contacts.

	PART NUMBER	SUPPLIER CODE	NOMENCLATURE	APPLICATION
				(MIL-DTL-83723 connector supersedes MIL-C-83723 and MIL-DTL-5015 connector supersedes MIL-C-5015).
R	Model 177 (see NOTE 1)	80164	Digital Multimeter (100 ohm scale)	Used to measure continuity.
R	Model 260 (see NOTE 2)	16902	Ohmmeter (100 ohm scale)	Used to measure continuity.
	HT250-4	11851	Retention Test Tool	Used to test the 16 and 20 gage contact retention.
	67-016-01	11851	Replacement Socket Tip	Replacement tip for testing 16 gage contacts with retention test tool.
	68-016-01	11851	Replacement Pin Tip	Replacement tip for testing 16 gage contacts with retention test tool.
	67-020-01	11851	Replacement Socket Tip	Replacement tip for testing 20 gage contacts with retention test tool.
	68-020-01	11851	Replacement Pin Tip	Replacement tip for testing 20 gage contacts with retention test tool.
	Strip Master No. 45-092	11851	Wire Stripper	Used to strip the wire for contact replacement.
	M22520/7-01	11851	Crimp Tool Frame	Used to crimp the contact on the wire.
	M22520/7-03	11851	Crimp Tool Positioner, 16 gage	Used with the crimp tool frame to crimp all the 16 gage contacts on the wire.

PART NUMBER	SUPPLIER CODE	NOMENCLATURE	APPLICATION
M22520/7-02	11851	Crimp Tool Positioner, 20 gage	Used with the crimp tool frame to crimp all the 20 gage contacts on the wire. This does not include MIL-DTL-38999 contacts, which supersede MIL-C-38999.
M22520/7-08	11851	Crimp Tool Positioner, 20 gage	Used with the crimp tool frame to crimp the 20 gage MIL-DTL-38999 contacts on the wire. (Supersedes MIL-C-38999)

R NOTE 1 : It is not necessary to use Model 177. An equivalent digital
R multimeter, available by local purchase, is permitted to use.
R NOTE 2 : It is not necessary to use Model 260. An equivalent ohmmeter,
R available by local purchase, is permitted to use.

D. General

WARNING : DO NOT USE HEAT GUNS, SOLDERING GUNS OR SOLDERING IRONS FOR THE ON-WING REPAIRS. THEY ARE NOT RESISTANT TO EXPLOSION AND CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(1) This chapter gives the procedure to replace a damaged or open circuit cable with a new shielded cable. The new cable will be installed on the external side of the damage wire harness and in the harness clamps. For replacement cable, use the same type as the damaged cable.

(2) Replace the repaired cables when the harness is removed or during the next shop visit of the engine.

(3) These are the wire harness parts :

(a) Wire - A single electrical conductor with insulation around it.

(b) Cable - A group of wires in a metal shield and an insulated jacket.

(c) Harness - A single cable or two or more cables with connectors or terminal lugs attached to the ends of the cables.

(4) Refer to the applicable wire harness located in the Power Plant Illustrated Parts Catalog to identify the correct adapter assembly part number.

(5) Refer to the Aircraft Wiring List, Equipment List for the connector Function Identification Number (FIN) and to get the correct part number.

(6) Refer to the Aircraft Wiring List for the correct wire type, gage, length and connector contact-to-contact hook-ups.

(7) Refer to the Power Plant Illustrated Parts Catalog to identify alternate part numbers.

(8)Refer to the wiring - connector/insert arrangement (Ref. 70-71-12, P. Block 1) for the connector contact/insert information.
(9)Refer to the wiring - harness lacing (Ref. 70-71-14, P. Block 1) for the harness lacing procedures.
(10)Standard equipment and consumable materials can be replaced with equivalent items.
(11)Always obey the specific procedures and limits in the specific AMM maintenance tasks.

E. Procedure to prepare the new cable
(1)Install a new cable on the external side of the harness as follows :
(a)Find the two connectors which are attached to the ends of the damaged cable.
(b)Get the replacement cable.
1 Refer to the Aircraft Wiring List, 92-90 Master Wire List for the correct replacement cable.
(c)Put one end of the new cable 6 in. (150 mm) longer than the connector on the damaged harness.
CAUTION : DO NOT LET THE WEIGHT OF THE HARNESS HANG ON THE ELECTRICAL CONNECTOR. IF YOU DO, YOU CAN CAUSE STRESS OR DAMAGE TO THE CONNECTOR OR HARNESS.
(d)Temporarily attach the new cable to the external side of the harness with tape.
(e)Put the new cable along the external side of the harness until it extends 6 in. (150 mm) more than the other harness connector and cut the cable.
(f)Install the new cable in all of the clamps located on the damaged harness as follows :
1 Open the first clamp on the harness located rearward of the connector.
2 Put the replacement cable in the clamp, on the external side of the harness.
3 Pull the cable tight, flat and equal against the harness and close the clamp handtight.
NOTE : You must keep the tracer cord outboard for the entire length of the harness.
4 Start at the next applicable clamp and do steps again until you have put the replacement cable in all the clamps for the affected part of the harness.
(g)Make sure the replacement cable is tight, flat and equal along the harness in the hinged clamps.
(h)Tie Lacing Tape (Material No.P05-245) around the harness and replacement cable between each of the clamps.
(j)Install the lacing tape (Material No.P05-245) in the center of the harness between the two clamps.
1 Refer to the wiring - harness lacing procedure (Ref. 70-71-14, P. Block 1).
(k)TORQUE the clamp bolts to between 36 and 40 lbf.in. (0.40 and 0.45 m.daN).
(l)Cut the other end of the cable 6 in. (150 mm) longer than the damaged cable at the other connector.

(m)Use the tape to temporarily attach the new cable to the external side of the connector.

F. Remove the backshell at each end of the harness
(1)Use the TG-69 Pliers or TG-70 strap wrench to disconnect the applicable electrical connector(s).
(2)If necessary, remove the adapter plate assembly and receptacle from the engine bracket. Refer to the wiring - harness adapter plate replacement procedure (Ref. 70-71-25, P. Block 1).
(3)Remove the applicable backshells at each end of the applicable harness. Refer to the wiring - connector and backshell replacement procedure (Ref. 70-71-20, P. Block 1).

G. Connect the repaired wires into the connector
(Ref. Fig. 001, 002, 003)
(Ref. Fig. 004, 005, 006)
(1)If necessary, remove the lacing tape to permit the removal of the contacts.
(2)Remove the contacts from the connector that are necessary to replace the damaged cable as follows :
NOTE : The modified MIL-DTL-26500 series (SUPERSEDES MIL-C-26500 Series) connectors have contacts that are released from the front of the connector (with the contact removal tool) and then removed from the rear of the connector.
NOTE : All other series connectors have contacts that are released from the rear of the connector and then removed (with the contact removal tool) from the rear of the connector.
(a)Use the applicable contact removal tool given in the standard equipment for the correct size contact.
CAUTION : IF TOO MUCH PRESSURE IS USED WHEN YOU REMOVE THE CONTACTS FROM THE CONNECTOR, DAMAGE TO THE COLLET, CONTACT AND GROMMET CAN OCCUR.
(b)Remove the front release contacts as follows :
1 Insert the contact removal tool on a contact located in the front face of the connector.
2 Push the contact removal tool into the grommet until it touches the bottom.
NOTE : When the tool touches the bottom of the connector grommet, it will expand the collet from the contact and permit the contact to release from the connector. The tool will start to push the contact and wire out the rear of the connector, but not fully.
3 Remove the contact and wire from the rear of the connector.
4 Remove the tool.
5 Put a label on the wire to identify the contact number.
6 Do this procedure again for the other contacts you will remove.
(c)Remove the rear release contacts as follows :
CAUTION : IF TOO MUCH PRESSURE IS USED WHEN YOU REMOVE THE CONTACTS FROM THE CONNECTOR, DAMAGE TO THE COLLET, CONTACT AND GROMMET CAN OCCUR.
1 Put the contact removal tool on the wire.
2 Move the tool back on the wire while you hold the wire tight.

NOTE : This will permit the wire to go into the slot of the tool.

3 Push the tool along the wire into the rear of the connector grommet until it touches the bottom.

NOTE : When the tool touches the bottom of the connector grommet, it will expand the collet from the contact and permit the contact to release from the connector.

4 Hold the wire against the serrated shoulder of the tool with light hand pressure and remove the wired contact and tool.

5 Remove the tool from the wire.

6 Put a label on the wire to identify the contact number.

7 Do this procedure again for the other contacts you will remove.

(3) Do these steps to prepare each end of the new cable.
(Ref. Fig. 002)

(a) Cut and remove the insulation jacket of the new cable at the same location as the insulation jacket of the damaged cable.

(b) Push the braided shield down the insulated wires to make the braid become larger.

(c) Bend the braided shield ends in a U shape as shown in view A.

CAUTION : DO NOT CUT, NICK OR DAMAGE THE CONDUCTORS OR BRAIDED SHIELDS. THIS TYPE OF DAMAGE COULD RESULT IN A SHORTED CIRCUIT IN THE CONDUCTOR.

(d) Use a scriber to carefully make a hole in the braid as shown in view B.

(4) PUll the wires, one at a time, through the hole in the braid as shown in view C.
(Ref. Fig. 002)

(5) Pull the braid tight to make a flat and equal conductor.

(6) Cut the new insulated wires the same length as the wires of the damaged cable.

(7) Use the PN 45-092 mechanical wire stripper or equivalent to remove 0.250 in. (6.35 mm) of the wire insulation from the end of the conductors.

(8) Put the contact number labels from the hold insulated wires on the new cable insulated wires.

(9) Make sure the insulated wire color is correct.

(10) Cut off the old contacts and braided shields at the point where the braided shields fold back over the damaged cable jacket.

(11) Insulate each end of the damaged cable as follows :

(a) Wind two layers of black rubber tape (Material No.P05-248) around each end of the damaged cable.

(b) Start the tape wrap 0.500 in. (12.7 mm) from the end of the cable and extend the tape 0.500 in. (12.7 mm) more than the end of the cable.

(c) Use lacing tape (Material No.P05-245) and tie a clove hitch and square knot or surgical knot around the rubber tape (Material No.P05-248) wrap 0.250 in. (6.35 mm) from the end of the damaged cable.

(12) Get the correct replacement contacts.

(a) Refer to the Aircraft Wiring List, Equipment List for the connector Function Identification Number (FIN) to get the correct part number.

(13) Prepare the crimp tools as follows :

(a) Use the crimp tool frame and the applicable crimp tool positioner given in the standard equipment for the correct contact type and wire gage.

(b) Install the crimp tool positioner in the crimp tool frame as follows :

1 Remove the lock clip from the lock ring on the positioner.
2 Use the correct positioner which agrees with the contact type.
3 Put the positioner in the tool frame lock plate and align the positioner pins with the lock plate ring slots.
4 Push the positioner into the tool frame and turn the positioner 90 degrees in a clockwise direction until it locks in position.
5 Install the lock clip on the positioner lock ring.

(14)Crimp the contact to the wire as follows :

CAUTION : IF THE TOOL FRAME SELECTOR KNOB IS PUT IN THE WRONG POSITION, DAMAGE TO THE CONTACT AND WIRE CAN OCCUR. ALSO, THE CONTACT CAN BE LOOSELY CRIMPED ON THE WIRE.

(a)Remove the lock clip from the lock ring hole on the selector knob.
(b)Raise and turn the tool frame selector knob until the number of the knob agrees with the number on the positioner data plate for the correct wire gage.
(c)Install the lock clip in the lock ring hole.
(d)Align the number on the knob with the index mark on the tool frame and release the knob.
(e)Examine the wire to make sure the wire strands are not separated.
1 If necessary, carefully twist the wire strands in their normal direction of twist to fit the contact wire hole.
(f)Install the end of the conductor into the contact wire hole.
(g)Push the conductor into the contact wire hole until you feel it touches the bottom.

NOTE : If the insulation on the conductor was not removed correctly, the wire will not touch the bottom of the contact crimp barrel or there will be too much bare wire at the rear shoulder of the contact crimp barrel.

(h)Examine the contact to make sure you can see the conductor strands through the sight hole in the contact.
(j)Install the contact and conductor through the tool frame hole and into the positioner hole until it touches the bottom.

CAUTION : DO NOT RELEASE THE LATCH FOR THE CRIMP TOOL POSITIONER IF THE CRIMP TOOL FRAME HANDLE IS IN THE CLOSED POSITION. THE TOOL HANDLE MUST BE OPEN WHEN THE POSITIONER IS INSTALLED, REMOVED OR RELEASED. INCORRECT USE CAN CAUSE DAMAGE TO THE POSITIONER AND CRIMP TOOL FRAME.

(k)Move the tool frame handles together until the ratchet releases.
(l)Remove the crimped contact from the tool frame.
(m)Hold the wire tight and lightly pull on the contact to make sure the contact is crimped to the conductor.
(n)Do these previous steps until you crimp all the contacts on the conductors.

(15)Install the contacts on the connector as follows :
(a)Move the backshell rearward over the harness to permit the contacts to be inserted in the connector.
(b)Use the applicable contact insertion tool given in the standard equipment for the correct contact size.
(c)Install the insertion tool on the contact.

NOTE : Make sure you install the correct contact in the correct location.

(d)All contacts are installed and locked from the rear of the connector.
(e)Put the contact insertion tool on the wire.
(f)Hold the wire tight and move the tool rearward on the wire.
NOTE : This will permit the wire to go into the slot of the tool.
(g)Push the tool along the wire until the tip of the tool seats on the rear shoulder of the contact.
(h)Install the contact in the connector.
(j)Hold the connector in your hand.
(k)Use the label on the wire to identify the correct contact location.
1 Refer to the Aircraft Wiring List, 92-20 Hook-Up List for detailed wiring data.
CAUTION : IF TOO MUCH PRESSURE IS USED WHEN YOU INSTALL THE CONTACT INTO THE CONNECTOR, DAMAGE TO THE COLLET, CONTACT, AND GROMMET CAN OCCUR.
(l)Install the insertion tool with the wired contact, contacts that are not used, or stubwire assembly contact into the correct cavity at the rear of the connector with a strong and equal pressure.
(m)Remove the tool.
(n)Lightly pull back on the wire to feel if the contact is locked in the collet.
(p)Do these previous steps until you install all the contacts on the conductors.

H. Do a contact retention check
(Ref. Fig. 006)
(1)Do a contact retention check as follows :
NOTE : All the contacts must be locked in the connector. This includes all the not used contacts and stubwire assembly contacts.
(a)The contact retention force necessary to make sure the contact is locked in the connector is between 10 and 15 lfb. (44.5 and 66.7 N).
(b)Use the correct retention test tool, replacement pin, and replacement socket tools that are given in the Standard Equipment for the correct contact size.
(c)Use the pin replacement tips when you do a test of the socket contacts.
(d)Use the socket replacement tips when you do a test of the pin contacts.
CAUTION : BE CAREFUL WHEN YOU DO A CHECK OF THE CONTACTS. INCORRECT USE OF THE RETENTION TEST TOOL COULD RESULT IN DAMAGE TO THE CONNECTORS CONTACT, COLLET, GROMMET AND TEST TOOL.
(e)Put the applicable 16 or 20 gage retention test tool and replacement pin or replacement socket on the contact so they are in a straight line.
(f)Keep this position when you do a test on each contact to get the most accurate results.
(g)Apply hand pressure to the tester until the indicator band located on the replacement pin or socket is in line with the body of the tester.
(h)At this point, there is 13 lbf. (57.8 N) of pressure applied.
(j)If the contact is still in position, the contact retention is satisfactory.
(k)Do these previous steps again for all the other contacts that were installed in the connector.
(l)All contacts must be locked in position.

J. Install the backshell at each end of the harness
(1)If necessary, install only the lacing tape (Material No.P05-245) you removed before. Refer to the wiring - harness lacing (Ref. 70-71-14, P. Block 1) for the harness lacing procedures.
(2)Install the applicable backshells on the connectors. Refer to the wiring - connector and backshell replacement procedure (Ref. 70-71-20, P. Block 1).
(3)If necessary, install the electrical adapter plate. Refer to the wiring - adapter plate replacement procedure (Ref. 70-71-25, P. Block 1).

K. Do the electrical checks
CAUTION : DO NOT BEND OR PUT STRESS ON THE CONTACTS WHEN YOU DO THE TEST. DAMAGE TO THE CONNECTOR OR CONTACT CAN OCCUR.
(1)Use the TG-69 pliers or the TG-70 strap wrench to disconnect the wire harness connectors which attach to the ends of the circuits that you will do a test of.
(2)Do the wire continuity check as follows :
(a)Do a wire continuity check on all the contacts from point-to-point (from one end of the wire to the other end of the wire).
R (b)Use a Digital Multimeter or Ohmmeter.
(c)Measure the resistance on all circuits.
(d)Each circuit must have continuity from one end of the wire to the other end of the wire.
NOTE : Refer to the Aircraft Wiring List, 92-90 Master Wire List for detailed pin-to-pin and wire color data.
(3)Do the insulation resistance check as follows :
WARNING : DO NOT USE A MEGOHMMETER FOR THE INSULATION RESISTANCE TEST OF THE ON-WING WIRE REPAIR. THIS COULD RESULT IN INJURY TO PERSONS OR DAMAGE TO THE AIRPLANE.
CAUTION : YOU MUST DISCONNECT ALL THE CONNECTORS ON THE CIRCUIT WHICH YOU WILL CHECK. IF YOU DO NOT DO THIS, IT CAN CAUSE UNSATISFACTORY RESISTANCE INDICATIONS AND POSSIBLE DAMAGE TO THE CIRCUITS.
CAUTION : DO NOT BEND OR PUT STRESS ON THE CONTACTS WHEN YOU DO THE TEST. DAMAGE TO THE CONNECTOR OR CONTACT CAN OCCUR.
R (a)Use a Digital Multimeter or Ohmmeter.
(b)Set the ohmmeter to the 100K ohm scale.
(c)Attach the ohmmeter test leads for insulation resistance check (wire to wire) as follows :
1 Attach one ohmmeter test lead to one contact.
2 Connect the other lead to the other contacts, one at a time, which do not connect to the same circuit.
3 Measure the insulation resistance.
4 The resistance must be a minimum of 100K ohms.
5 Do the procedure again for all the other wires you will do a test of.
(d)Attach the ohmmeter test leads for insulation resistance check (wire to ground) as follows :
1 Attach one ohmmeter test lead to the backshell.
2 Connect the other lead to all contacts, one at a time.
3 Measure the insulation resistance.

4 The resistance must be a minimum of 100K ohms.
5 Do the procedure again for all the other wires you will do a test of.
(e)Remove the ohmmeter leads.

L. Connect the connectors

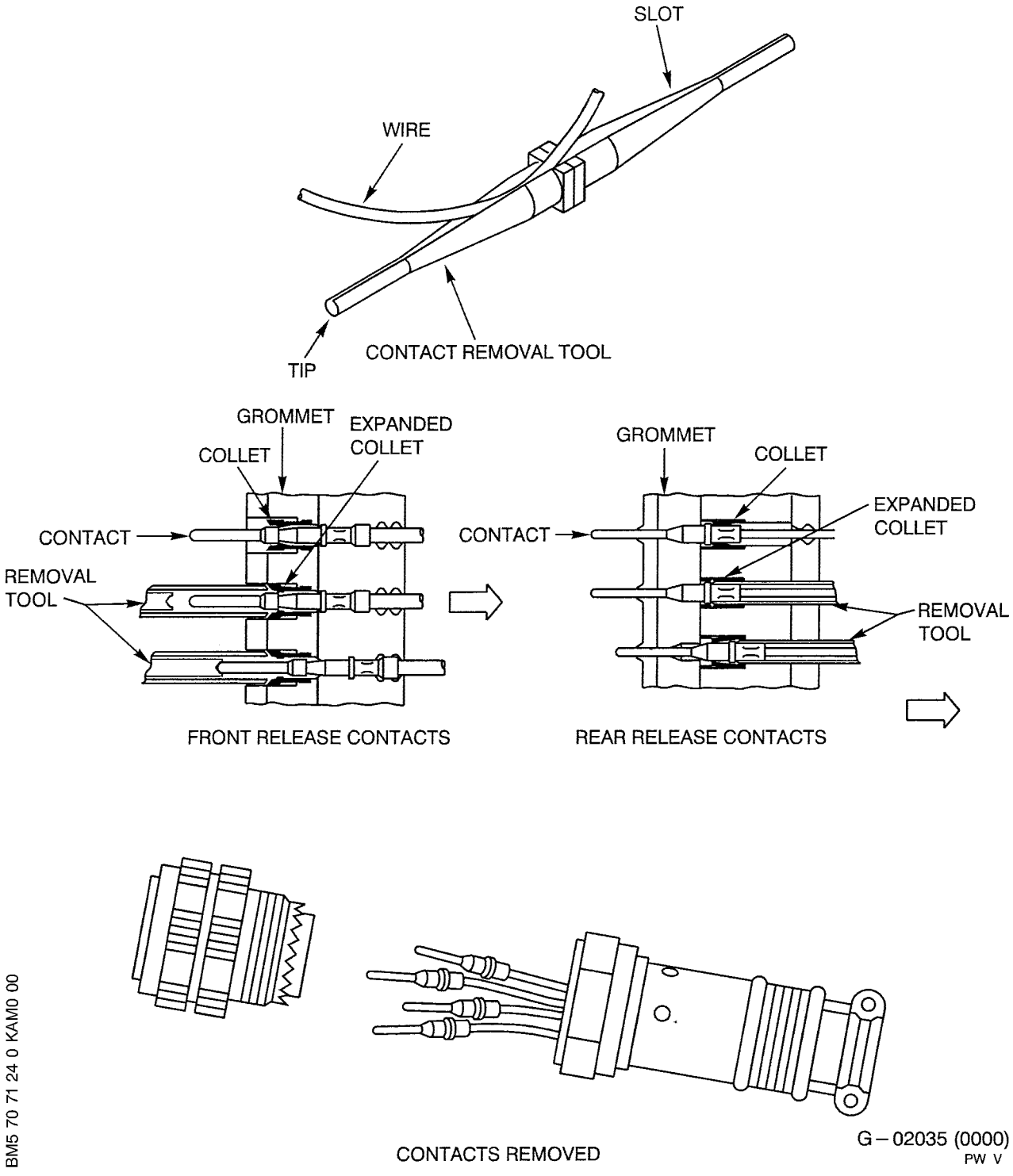
CAUTION : USE THE CORRECT ASSEMBLY PROCEDURE AND TOOLS WHEN YOU INSTALL THE HARNESS CONNECTOR. IF YOU DO NOT, THE CONNECTOR CAN BECOME LOOSE OR DAMAGED. A LOOSE CONNECTOR CAN CAUSE THE ENGINE TO OPERATE INCORRECTLY WITH THE RISK OF AN IN FLIGHT SHUTDOWN.

CAUTION : DO NOT USE A METAL JAWED TOOL TO TIGHTEN THE CONNECTOR. THIS WILL CAUSE DAMAGE TO THE CONNECTOR.

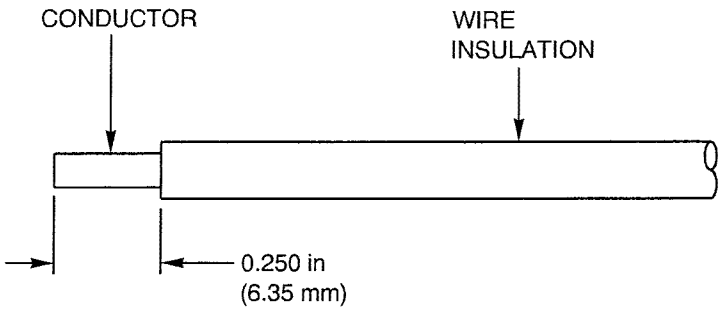
(1)Connect the electrical connector as follows and in the correct sequence as shown below :
(a)Examine, align the keyway, and engage the connector.
(b)Push lightly inward on the connector while tightening the coupling ring.
(c)Use the soft jaw pliers or the strap wrench and tighten the connector against the receptacle.
(d)While you tighten, push the connector in and from side to side.
(e)For self-locking connectors, make sure you can feel the ratchet feature.
(f)Tighten the connector until the pliers or strap wrench slip on the connector ring.
(g)For non-self-locking connectors, safety the connector with the lockwire specified in the specific AMM procedure.

M. Test the Engine

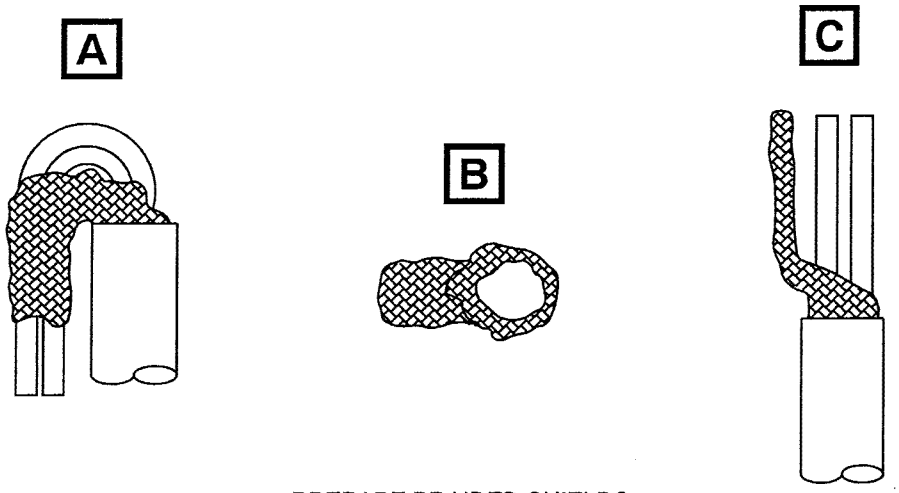
(1)Test the engine. Refer to the specific AMM test reference table, Test Requirements After Engine/Module/Component Repairs or Replacement (Ref. 71-00-00, P. Block 501).



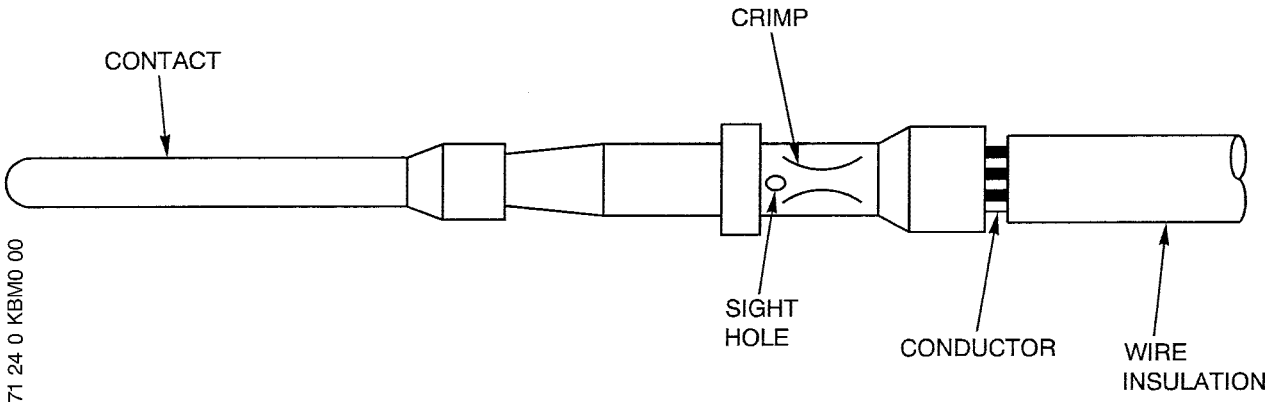
Shielded Wire Replacement Procedure
Figure 001



CONDUCTOR DIMENSION



PREPARE BRAIDED SHIELDS



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INSTALLED CONTACT

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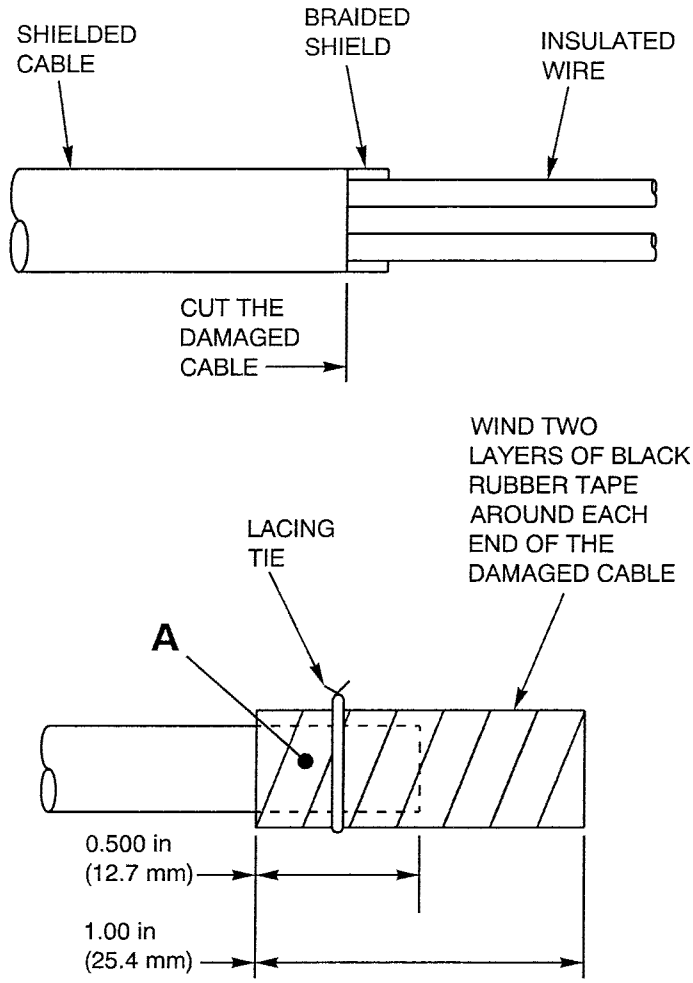
PW V

Shielded Wire Replacement Procedure
Figure 002



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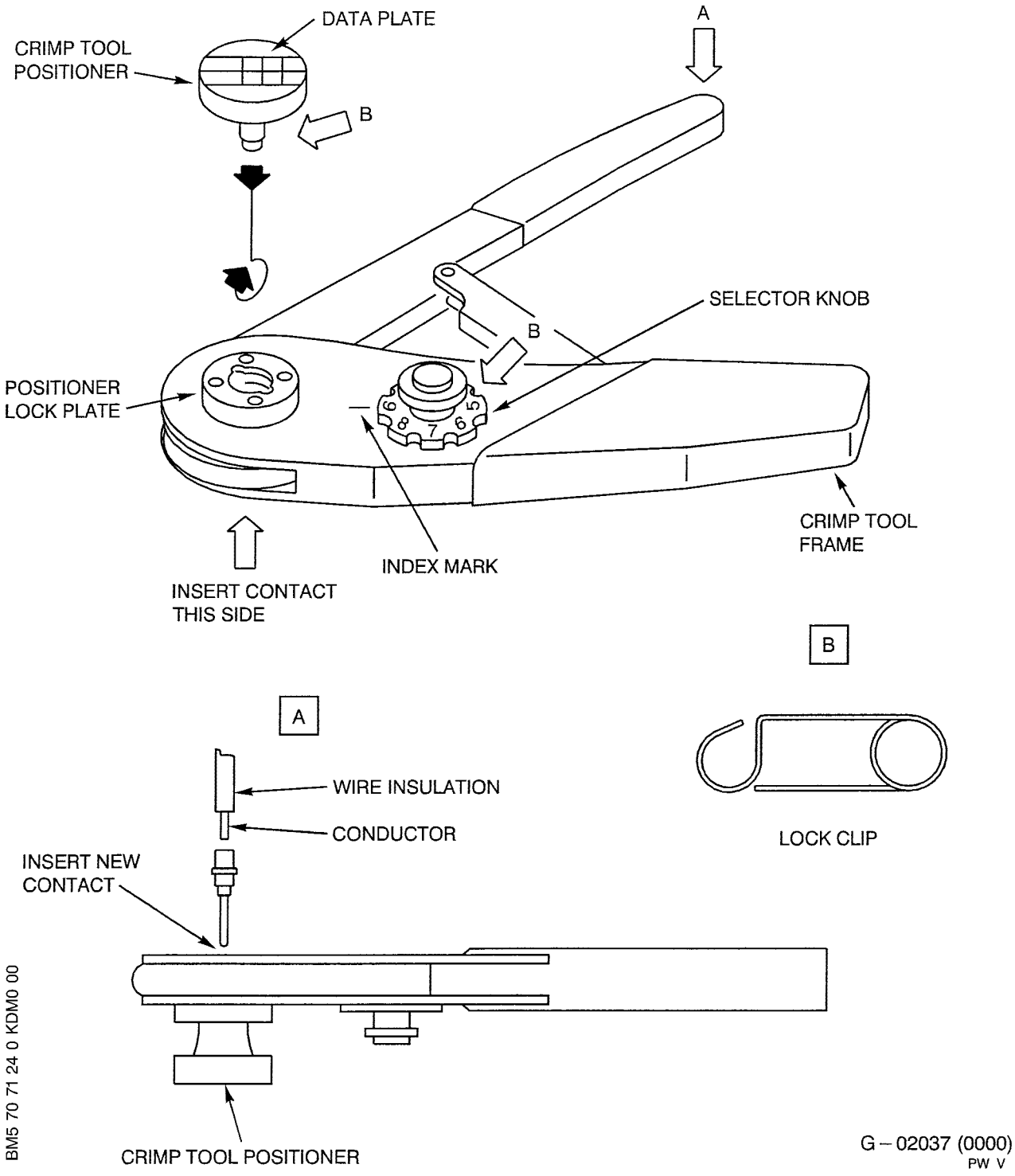
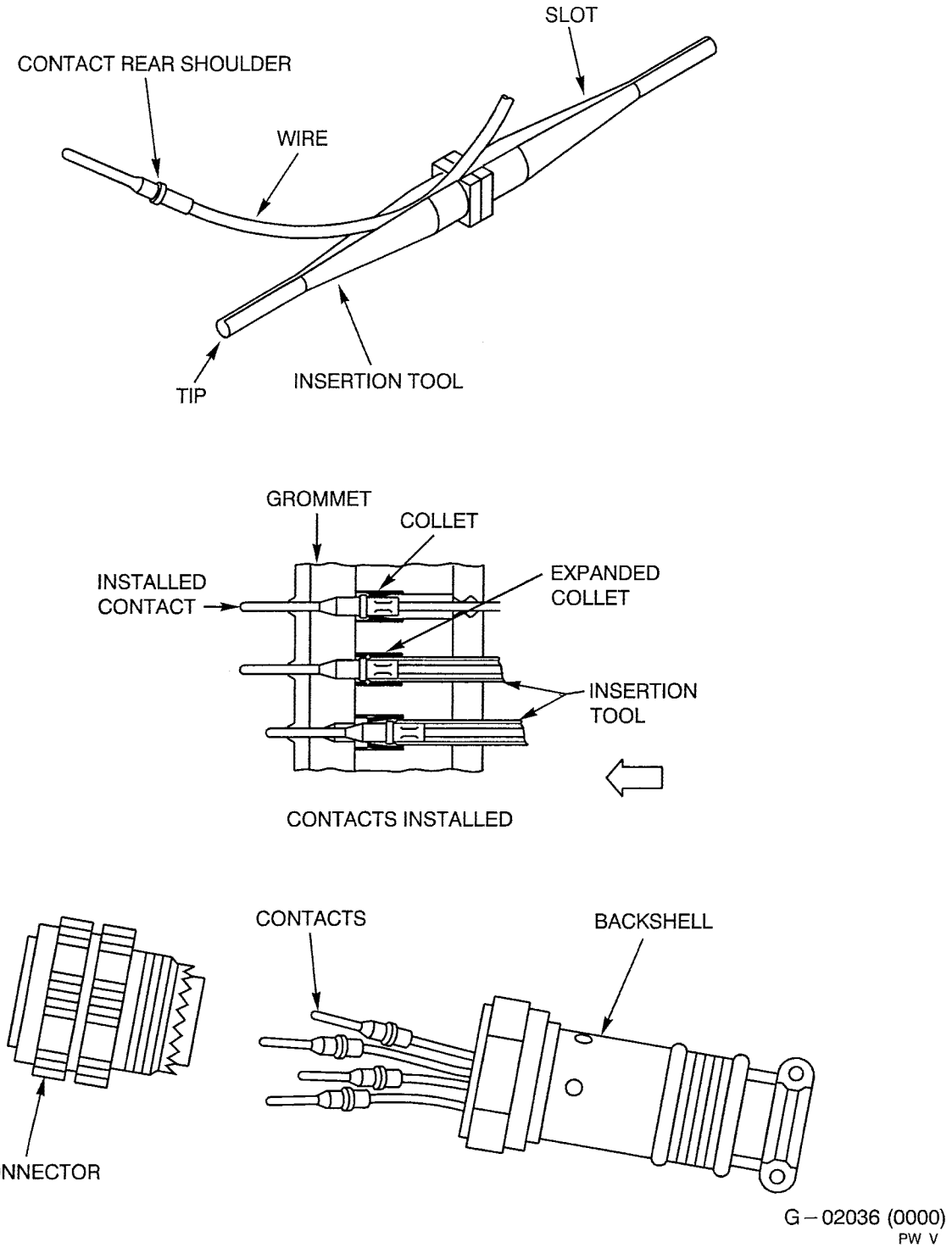
PW V

Shielded Wire Replacement Procedure
Figure 003



Shielded Wire Replacement Procedure
Figure 004



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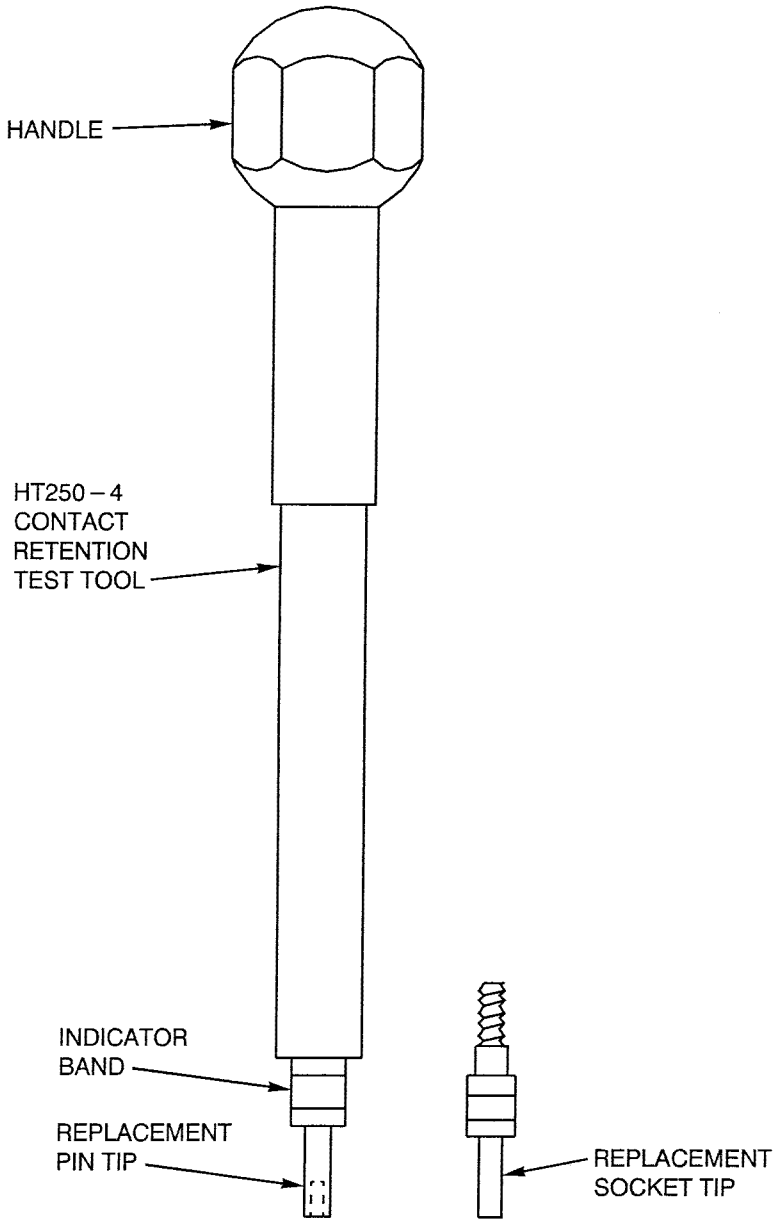
Shielded Wire Replacement Procedure
Figure 005



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PW V

Shielded Wire Replacement Procedure
Figure 006

WIRING - HARNESS ADAPTER PLATE REPLACEMENT

1. Adapter Plate Replacement Procedure

A. Reason for the Job

(1)Use this procedure to replace the adapter plate assemblies that are installed on the WC1, WC2 and WC8 wire harnesses.

B. Equipment and Materials

ITEM	DESIGNATION
(1)	Strap Wrench (Available from Supplier Code 11851 or 06324, Part Number TG-70) or Soft Jaw Pliers (Available from Supplier Code 11851 or 06324, Part Number TG-69)
(2)Material No.P03-001	Oils (Ref. 70-00-00)
Referenced Procedures	
- 70-00-00, P. Block 201	Standard Practices - General
- 71-00-00, P. Block 501	Power Plant - General

C. General

WARNING : DO NOT USE HEAT GUNS, SOLDERING GUNS OR SOLDERING IRONS FOR THE ON-WINGS REPAIRS. THEY ARE NOT RESISTANT TO EXPLOSION AND CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(1)This chapter gives the procedure to replace the adapter plate that are installed on some wire harnesses.

(2)These are the wire harness parts :

(a)Wire - A single electrical conductor with insulation around it.

(b)Cable - A group of wires in a metal shield and an insulated jacket.

(c)Harness - A single cable or two or more cables with connectors or terminal lugs attached to the ends of the cables.

(3)To identify the correct adapter part number, refer to the applicable wire harness located in the Power Plant Illustrated Part Catalog. Standard equipment and consumable materials can be replaced with equivalent items.

D. Procedure

(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.

(2)Use the TG-69 pliers or TG-70 strap wrench to disconnect the applicable electrical connector(s).

(3)Remove the adapter plate from the engine bracket as follows :

(a)Remove the bolts that attach the adapter plate to the engine bracket.

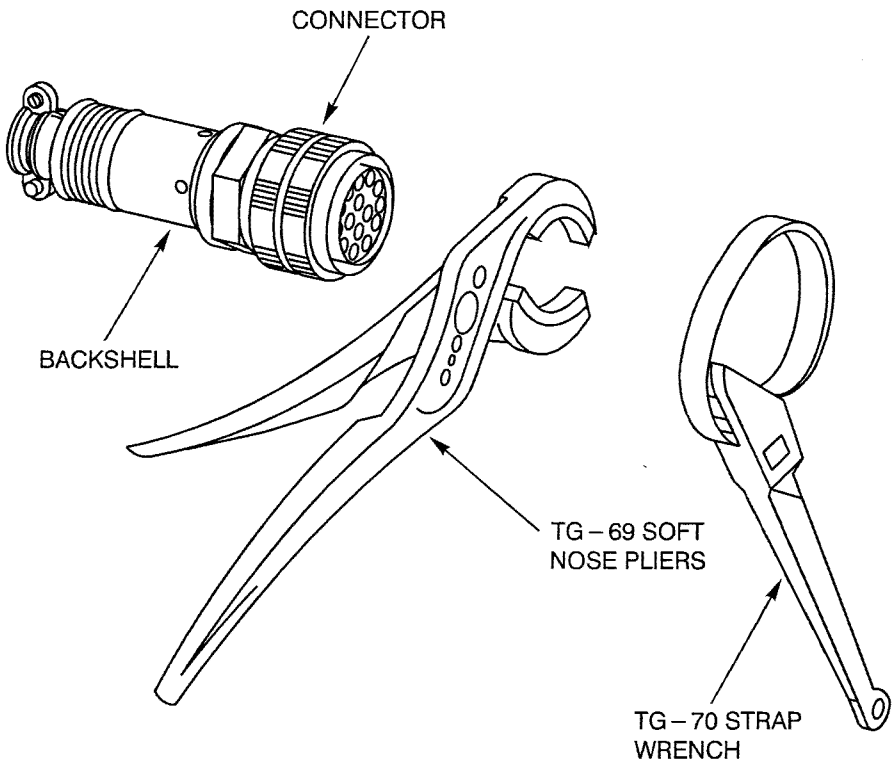
(b)Remove the adapter plate and receptacle from the engine bracket.

(4)Remove the adapter plate from the receptacle as follows :

(a)Mark the location of the master key-way of the receptacle on the adapter plate.

(b)Remove the nuts and screws that attach the receptacle to the adapter

plate.
(c)Remove the receptacle from the adapter plate.
(5)Get the replacement adapter plate.
(6)Install the replacement adapter plate as follows :
(a)Make a mark on the replacement adapter plate in the same location as the mark on the old adapter plate.
(b)Align the master key-way on the receptacle with the mark you made on the adapter plate.
(c)Install the receptacle in the adapter plate.
(d)Install the screws through the adapter plate and receptacle.
(e)Attach the nuts to the screws and tighten.
(f)Torque the nuts as follows.
1 TORQUE the No. 4-40 nuts to a maximum of 5 lbf.in. (0.056 m.daN).
2 TORQUE the No. 6-32 nuts to a maximum of 10 lbf.in. (0.113 m.daN).
(7)Install the adapter plate to the engine bracket as follows :
(a)Apply engine oil (Material No.P03-001) to the bolts.
(b)Install the adapter plate on the engine bracket.
(c)Install and tighten the bolts.
(d)TORQUE the bolts to between 36 and 40 lbf.in. (0.41 and 0.45 m.daN).
(8)Connect the electrical connector as follows and in the correct sequence as shown below :
CAUTION : USE THE CORRECT ASSEMBLY PROCEDURE AND TOOLS WHEN YOU INSTALL THE HARNESS CONNECTOR. IF YOU DO NOT, THE CONNECTOR CAN BECOME LOOSE OR DAMAGED. A LOOSE CONNECTOR CAN CAUSE THE ENGINE TO OPERATE INCORRECTLY WITH THE RISK OF AN IN FLIGHT SHUTDOWN.
CAUTION : DO NOT USE A METAL JAWED TOOL TO TIGHTEN THE CONNECTOR. THIS WILL CAUSE DAMAGE TO THE CONNECTOR.
(a)Examine, align the keyway, and engage the connector.
(b)Push lightly inward on the connector while tightening the coupling ring.
(c)Use the soft jaw pliers or the strap wrench and tighten the connector against the receptacle.
(d)While you tighten, push the connector in and from side to side.
(e)For self-locking connectors, make sure you can feel the ratchet feature.
(f)Tighten the connector until the pliers or strap wrench slip on the connector ring.
(g)For non-self-locking connectors, safety the connector with the lockwire specified in the specific AMM procedure.
(9)Test the engine. Refer to the specific AMM Test Reference Table, Test Requirements After Engine/Module/Component Repairs or Replacement (Ref. 71-00-00, P. Block 501).
(Ref. Fig. 001)
(Ref. Fig. 002)



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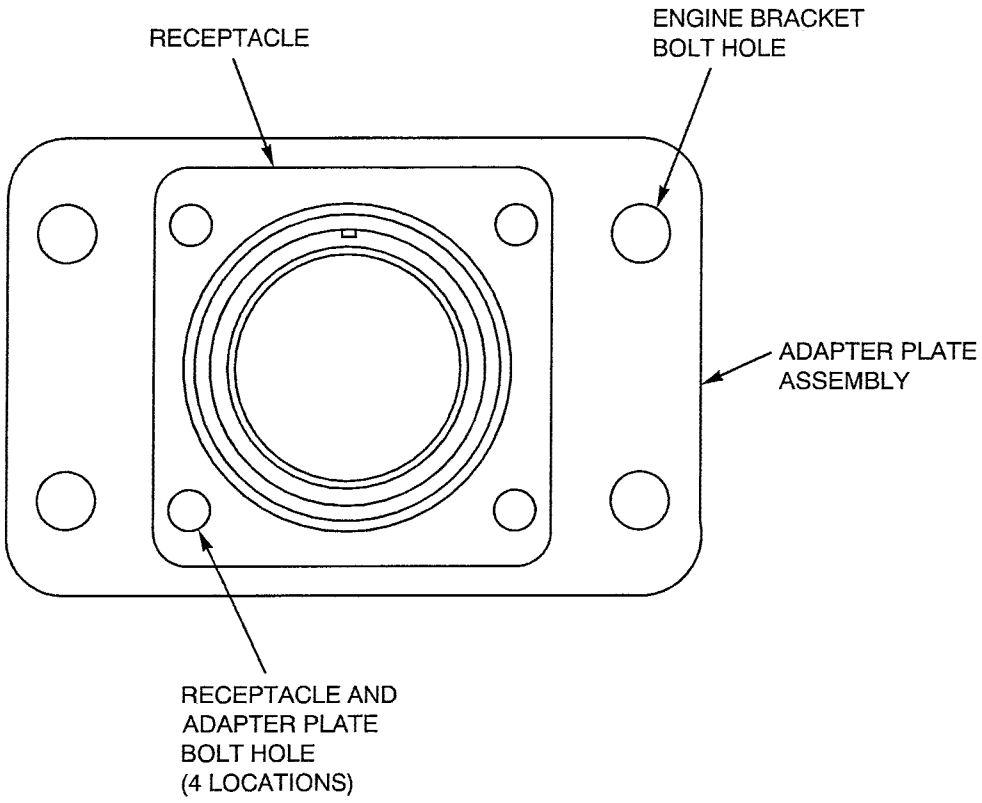
PW V

Adapter Plate Replacement Procedure
Figure 001



EXAMPLE OF AN ADAPTER PLATE ASSEMBLY

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NOTE: THE NUMBER OF ENGINE BRACKET BOLT HOLES CHANGE WITH THE SHAPE OF THE DIFFERENT ADAPTER PLATE ASSEMBLIES

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PW V

Adapter Plate Replacement Procedure
Figure 002

WIRING - HARNESS DISCONNECT MARKER AND NUMBER MARKER REPAIR
DESCRIPTION AND OPERATION

1. Disconnect and Harness Identification Marker Repair Procedure

A. Reason for the Job

(1) Use this procedure to repair or put a new identification on a disconnect marker or harness marker.

B. Equipment and Materials

ITEM	DESIGNATION
(1) No specific	Permanent Ink (as specified in Standard Practices) (Ref. 70-00-00, P. Block 201)
(2) Material No.P05-111	Special Materials (Ref. 70-00-00)
Referenced Procedures	
- 70-00-00, P. Block 201	Standard Practices - General
R - 70-71-14, P. Block 1	Wiring - Harness Lacing

C. General

WARNING : DO NOT USE HEAT GUNS, SOLDERING GUNS OR SOLDERING IRONS FOR THE ON-WINGS REPAIRS. THEY ARE NOT RESISTANT TO EXPLOSION AND CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(1)This chapter gives the procedure to repair or put a new identification on a disconnect marker or harness marker.
(2)The disconnect identification marker is located on the harness near each connector and backshell assembly.
(3)The harness identification marker is located at one location on the harness.
(4)These are the wire harness parts :
  (a)Wire - A single electrical conductor with insulation around it.
  (b)Cable - A group of wires in a metal shield and an insulated jacket.
  (c)Harness - A single cable or two or more cables with connectors or terminal lugs attached to the ends of the cables.
(5)Standard equipment and consumable material can be replaced with equivalent items.

D. Procedure

(1)Always obey the specific procedures and limits in the specific AMM maintenance tasks.
(2)Cut the lacing tape and remove the chafe guard sleeve that covers the identification marker.
(3)Remove the marker and tape from the harness.
(4)Draw a line through the old identification number on the marker with black permanent ink. Refer to marking parts (Ref. 70-00-00, P. Block 201).
(5)Write the new identification number on the marker with black permanent ink. Refer to marking parts (Ref. 70-00-00, P. Block 201).
(6)Put the marker on the harness at the same position it was removed.
(7)Wind two layers of fiberglass insulating tape (Material No.P05-111) around each edge of the marker.
  (a)The fiberglass tape you removed can be used again.
  (b)Do not cover the marker label with tape.
(8)Install the chafe guard sleeve around the marker and tie the chafe guard with lacing tape. Refer to the wire harness lacing procedure (Ref. 70-71-14, P. Block 1).

WIRING - CABLE STAINLESS STEEL WIRE BRAID REPAIR
DESCRIPTION AND OPERATION

1. Cable Stainless Steel Wire Braid Repair

A. Reason for the Job

(1)Use this repair for electrical cable wire braid covering which is worn, broken, cut or otherwise damaged.

B. Equipment and Materials

ITEM	DESIGNATION
(1)No specific	Jeweler's Snips (Wiss Mo. J7 or equivalent)
(2)No specific	Tinned Copper Grounding Strap
(3)Material No.P05-111	Special Materials (Ref. 70-00-00)
(4)Material No.P05-289	Special Materials (Ref. 70-00-00)
(5)Material No.P05-332	Special Materials (Ref. 70-00-00)
Referenced Procedures	
- 70-00-00, P. Block 201	Standard Practices - General
- 71-00-00, P. Block 501	Power Plant - General

C. General

WARNING : DO NOT USE HEAT GUNS, SOLDERING GUNS OR SOLDERING IRONS FOR THE ON-WINGS REPAIRS. THEY ARE NOT RESISTANT TO EXPLOSION AND CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(1)Standard equipment and consumable materials can be replaced with equivalent items.

(2)Always obey the specific procedures and limits in the specific AMM maintenance tasks.

D. Procedure

(Ref. Fig. 001)

NOTE : The number steps in this procedure are the same as the number steps in the figure.

(1)Prepare the damaged area as follows :

(a)Use jeweler's snips (Wiss No. J7 or equivalent) to carefully cut the steel braid around the circumference at damaged area.

(b)Move the two sections of braid apart.

(2)Install the ground strap across the damaged area as follows :

(a)Put two layers of fiberglass tape (Material No.P05-111) (or equivalent) around the wire bundle in damaged area.

(b)Put a piece of tinned copper ground strap across the taped area under the braid.

(c)Push the ends of braid over the ground strap and as close together as possible.

(3)Put two layers of fiberglass tape (Material No.P05-111) (or equivalent) around the cable over the braid, 0.250 in. (6.35 mm) from the end of the braid ends on each side of the cut.

(4)Fold the braid ends and install more tape as follows :

(a)Carefully fold the braid back over the tape.

CAUTION : BE SURE ALL LOOSE WIRE BRAID ENDS ARE CAREFULLY FOLDED BACK OVER THE TAPE. IF THERE IS ANY PENETRATION BY THE WIRE BRAID INTO THE INSULATION AND WIRES, MALFUNCTION OF THE CABLE CAN OCCUR.

(b)Put two layers of fiberglass tape (Material No.P05-111) (or equivalent) around the cable over the braid ends, on each side of the cut.

(5)Apply more tape as follows :

(a)Put enough layers of fiberglass tape (Material No.P05-111) (or equivalent) between the braid ends so that the repair area has the same diameter.

(b)Put two more layers of fiberglass tape (Material No.P05-111) (or equivalent) around the cable over the entire repair area.

(6)Install safety wire (lockwire) over the repair area as follows :

(a)Wrap the repair area with lockwire (Material No.P05-332 or P05-289) as shown in the figure.

(b)Cut enough wire and loop one end.

(c)Hold the wire snugly against the cable braid to left.

(d)Start at the opposite end and tightly and evenly wrap the wire over the cable braid and the repaired area.

NOTE : Be sure that wire overlaps fiberglass insulating tape and contacts wire braid at each end of repair.

(e)When approximately two-thirds of wrap is complete, let the short end of the loop show.

(f)Continue to wrap the wire to complete the remaining distance (shown as "1/3 X" in the figure).

(g)The maximum repair length "X" is 4 in. (101.600 mm).

(h)After the final wrap, insert the wire (1) through the loop.

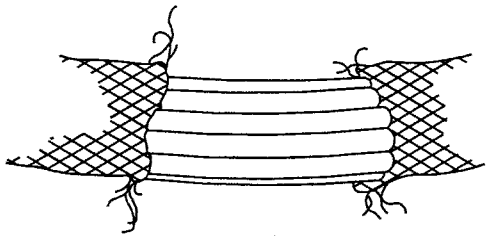
(j)Cut off the excess end of wire (2) so that the remaining length is approximately one third of the repair length.

(k)Pull the loop end (3) snug for a tight end loop then cut the wire end flush.

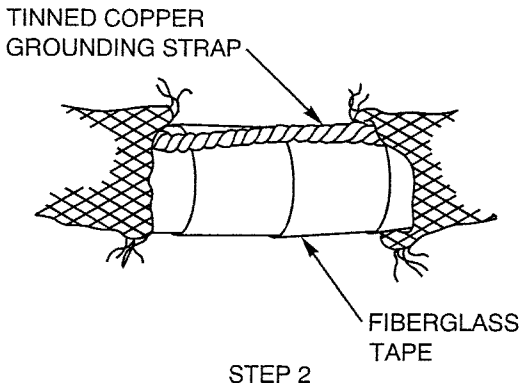
(7)Make sure that you fold the wire end so that you cannot get an injury.

E. Test the Engine

(1)Test the engine. Refer to the specific AMM test reference table, Test Requirements After Engine/Module/Component Repairs or Replacement (Ref. 71-00-00, P. Block 501).



STEP 1



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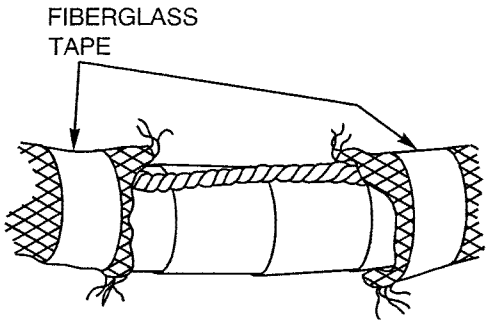

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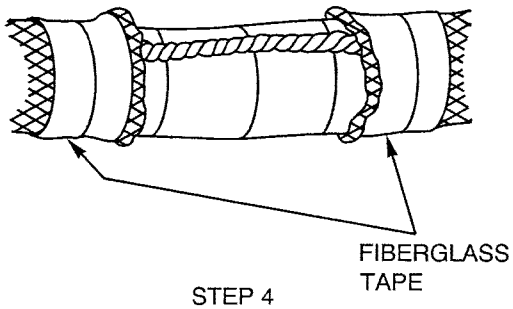
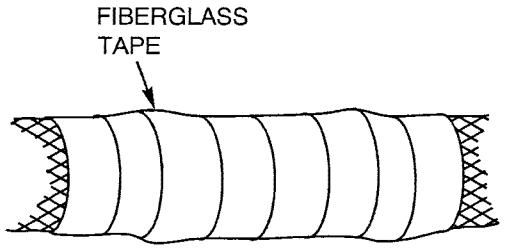
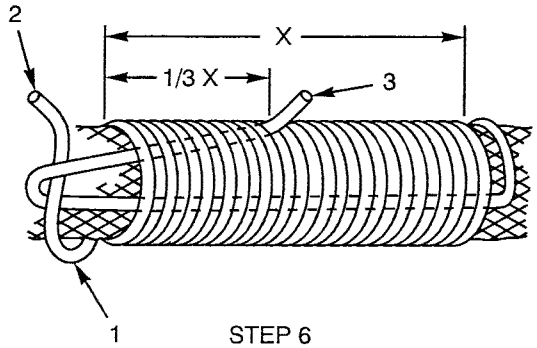


STEP 4



STEP 5



STEP 6

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Cable Stainless Steel Wire Braid Repair
Figure 001